LORAIN

Products Corporation

instructions

INSTALLATION

OPERATION

MAINTENANCE

DESIGNERS AND MANUFACTURERS OF

power equipment without moving parts SUB-CYCLE® CONVERTERS AND FLOTROL® RECTIFIERS

For Parts Or Service, Contact:

Lorain Products Corporation
Service Department
1122 "F" Street
Lorain, Ohio 44052
PH: (216) 288-1122
TWX: 810-426-2130

NOTE

PROGRAMMED PREVENTIVE MAINTENANCE Is Available On This And Other Lorain Products Manufactured Equipment. For Further Information, Contact "Service Manager" At The Above Address.

LORAIN MODEL L6A50

FLOTROL RECTIFIER

Spec. No. 5351-006 Serial No. 279

NOTICE

THIS FLOTROL IS ADJUSTED
TO 500 VOLTS. 2.17 VOLTS PER CELL
FOR A 23 CELL BATTERY. INPUT 120 VAC

OPTIONAL WIRING OR APPARATUS FURNISHED:
A, B, E, G, H, J, K, M, N, Q, R, S, T, V, W, X, Y, Z,
OTHER _____
MODEL NO. L6A50 SERIAL NO. 279
SD NO. 5351-006 ISS. NO. 8
DATE 12-17-74 PER LB

FOR PARTS OR SERVICE CONTACT

LORAIN PRODUCTS CORPORATION
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1122 "F" STREET
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3172-412

LORAIN PRODUCTS CORPORATION WARRANTY

Lorain Products Corporation warrants that all equipment manufactured by it shall be free from defects in material and workmanship. The corporation will, at its option, replace or repair free of charge and pay surface carrier charges on any adequately packed equipment covered by its warranty which shall be returned to the factory within 90 days from date of turn-on and found to be defective. All circuit components are warranted for two years from the original shipping date from the factory and which upon examination prove to be defective in material or workmanship. The corporation recommends that all shipments of equipment be inspected by the customer for hidden damage upon receipt from the carrier to insure that a timely claim be filed, if necessary, by the customer. Lorain Products Corporation will not pay claims for shipping damages.

Systems and Equipment Not Economically Returnable To The Factory

In the event that the product involved is a system or equipment which, in the judgment of Lorain Products Corporation, is not economically returnable to the factory or if Lorain Products Corporation has performed the installation, supervised the installation, or performed testing and turn-on, circuit components and Lorain repair labor are covered by this warranty for the first 90 days from date of turn-on and circuit components are warranted for two years from the date of shipment. Upon request, Lorain will send a service technician to the site to determine if the unit is defective in circuit components or workmanship, and will repair the equipment. If the failure is Lorain's fault, no invoice for circuit components or repair labor will be issued if the complaint has been issued within the first 90 days from date of turn-on. If the complaint is issued more than 90 days from the date of turn-on but within two years from the date of shipment, the customer will be billed at the prevailing Customer Service rates but will not be billed for circuit components. If the problem occurs after two years from the date of shipment, circuit components and repair labor are billable.

If the problem has been created by misuse or abuse of the equipment or by malfunction of associated equipment or by environmental conditions, at any time after shipment, the customer will be billed for circuit components and labor.

General Provisions

Lorain Products Corporation shall not be obligated to pay any costs or charges incurred by the customer or by any other party. In no event will Lorain Products Corporation be liable for consequential damages. No waiver, alteration or modification of any of the provisions herein shall be binding on Lorain Products Corporation unless in writing and signed by an authorized official of Lorain Products Corporation. If, during any warranty period, the subject equipment has, in the opinion of Lorain Products Corporation, been modified or misrepaired, the warranty will be void unless the modifications or repairs have been made after consultation with the corporation and upon the recommendation of the corporation.

1. SPECIFICATION

1.1 GENERAL: This FLOTROL Rectifier is designed to charge batteries.

1.2 OUTPUT RATINGS

1.2.1 Voltage: Float-equalize switch and adjustments provide separate voltages for floating and equalizing 23 or 24 cells of battery.

(A) Float: Adjustable from 48.0 to 54.0 volts

(B) Equalize: Adjustable from 48.0 to 58.0 volts

1.2.2 Regulation

(A) Static: Steady state output voltage remains within ± 1/2% of any voltage within the range of 48.0 to 54.0 volts for any load current from no load to full load and for input voltage and frequency specified below.

(B) Dynamic: For a step load change from 20% to 100% of full rated current, the maximum voltage transient will not exceed ± 5% of the initial steady state voltage. Recovery to within steady state voltage regulation range not to exceed 200 milliseconds and all transient behavior disappears within 500 milliseconds.

1.2.3 Filtering

(A) Voice Band Noise: When connected to a 24 ampere-hour battery, noise is less than 32 dbrn C message weighting, if measured at the battery terminals with a Western Electric Type 3A Noise Meter or equivalent.

(B) Wide Band Noise: Not to exceed 500 millivolts peak to peak or 30 millivolts RMS over the frequency range of 10 Hz to 14 million Hz when measured across a 24 ampere hour battery.

1.2.4 Current: 6 amperes

1.3 INPUT RATINGS

1.3.1 Voltage: Nominal 120 volts, single phase, 57 to 63 Hz with taps provided for 110 and 120 volts with a variation within ± 10% of tap voltage.

1.3.2 Typical Input Data

(A) At 52.08 Volts D-C Output

Voltage and Tap	Amount of Load	Amperes	Watts	VAR	VA	Efficiency
120	No Load	0.6	35	63	72	-
	Half Load	1.75	200	63	210	78%
	Full Load	3.30	385	92.7	396	81%

Power Factor: Varies between 95% with 132 volt input to 99% with 108 volt input on 120 volt tap at full load while floating 24 cells.

(B) At 56.4 Volts D-C Output

Current: 4.75 amperes at maximum overload with 99 volts on 110 volt tap

1.3.3 Noise Level

(A) Telephone Influence Factor: The IT Product of the input A-C current wave does not exceed 60 for any normal input and output condition.

(B) Total Harmonic Distortion: Total harmonic content of the input current under any rated input and output conditions will not exceed 20% of the fundamental component.

1. SPECIFICATION

1.4 STANDARD FEATURES

1.4.1 Rectification System: Controlled ferroresonance with silicon diode rectification

1.4.2 Input Protection: 6 ampere circuit breaker opens one side of the 120 volt service.

1.4.3 Output Protection

(A) Current Limiting: Circuit limits D-C output current to approximately 110% of full rated load. Adjustable from 90% to 125% full load.

(B) Short Circuit: One 9 ampere circuit breaker in negative lead.

(C) Over Voltage Shutdown: This FLOTROL Rectifier will shutdown should the battery voltage exceed 2.4 to 2.5 volts per cell. Factory set at 2.5 volts per cell unless otherwise specified.

1.4.4 Remote Voltage Sensing: Point of regulation may be extended to battery or power board terminals.

1.4.5 Alarms

(A) Rectifier output failure causes one alarm circuit to open, one alarm circuit to close and a RECTIFIER FAILURE alarm lamp to light.

(B) When the Charge Failure Alarm Assembly accessory is furnished, a low current alarm condition causes two alarm circuits to open, two alarm circuits to close and a RECTIFIER FAILURE alarm lamp to light.

(C) When the High and Low Voltage Alarm accessory is furnished, an alarm condition will cause two alarm circuits to close, two alarm circuits to open and a RECTIFIER FAILURE alarm lamp to light.

1.4.6 Conducted Radio Frequency Interference: Conducted radio frequency interference voltages in the frequency range of 0.15 to 25 MHz on the A-C input and D-C output lines will not exceed the broad band conducted interference limits of MIL-I-6181D.

1.4.7 Meters

(A) 0-80 volt, 2-1/2 inch rectangular type D-C voltmeter, ± 2% accuracy at full scale, Triplett 220G (or equivalent), 2.48 inch scale length.

(B) 0-10 ampere, 2-1/2 inch rectangular type D-C ammeter, ± 2% accuracy, Triplett 220G (or equivalent), 2.48 inch scale length.

1.4.8 Mounting: Angles provided for 19 or 23 inch relay rack mounting. Other mountings are available. See - Accessories, Paragraph 1.6.

1.5 ENVIRONMENTAL RATINGS

1.5.1 Operating Ambient Temperature Range: 0°C to +50°C (+32°F to +122°F)

1.5.2 Storage Temperature Range: -40°C to +85°C (-40°F to +185°F)

1.5.3 Heat Dissipation: 250 BTU/HR (120 volts on 120 volt tap with 52.08 volts output and full load)

1.5.4 Ventilation Requirements: In mounted position, unit should be located so that ventilating openings are not blocked and air entering cabinet does not exceed +50°C (+122°F). It may be necessary to allow 3-1/2 inches spacing and use a baffle plate between this and other heat producing equipment.

1.6 ACCESSORIES AVAILABLE BUT NOT INCLUDED WITH THIS FLOTROL RECTIFIER

1.6.1 Battery Eliminator Accessory (Shown on the schematic diagram as "K" Option): (1) Part No. 4826-143

(A) Voice Band: Reduces output noise to less than 32 dBrn, C-message weighting, without battery.

(B) Wide Band: Reduces output ripple to less than 30 millivolts, RMS, over a frequency range of 10 Hz to 14 million Hz.

When using this accessory, the specified dynamic regulation is maintained providing the step load change is restricted to 20% of full rated current within the range of 20% to 100%.

1.6.2 Charge Fail Alarm Assembly (Shown on the schematic diagram as "S" Option. Refer to pragraph 4.9): (1) Part No. 4846-105

1.6.3 High and Low Voltage Alarm Assembly (Shown on the schematic diagram as "N" Option. Refer to paragraph 4.10): (1) Part No. 4863-077

1.6.4 Mounting

(A) Adapter plate for 30 inch Unistrut relay rack: (2) of Part No. 3471-710

(B) Floor Stand: (1) Part No. 4121-019

1. SPECIFICATION

1.6 ACCESSORIES AVAILABLE BUT NOT INCLUDED WITH THIS FLOTROL RECTIFIER (CONT'D)

1.6.4 Equalize Charge Timer - This externally mounted accessory (Shown on the schematic diagram as "X" option) allows an equalize charge period up to 24 hours after which time the rectifier is returned to the float mode of operation: (1) Part No. 4843-817

1.6.5 Mounting
(A) Adapter plate for 30 inch Unistrut relay rack: (2) Part No. 3471-710
(B) Floor Stand: (1) Part No. 4121-019

1.7 MISCELLANEOUS

1.7.1 Schematic Diagram: SD5351-006

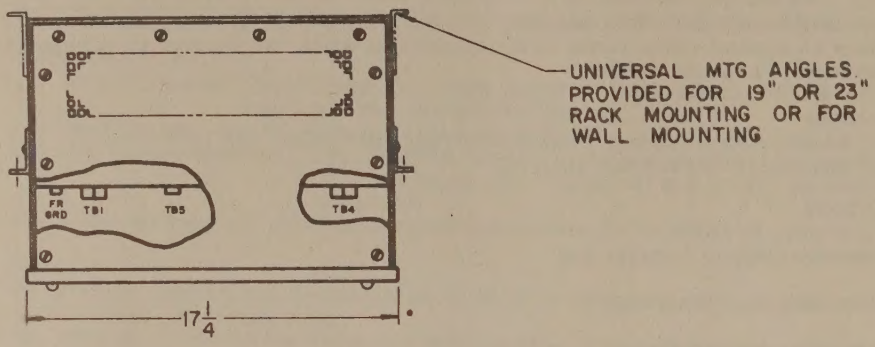
1.7.2 Wiring Diagram: T5351-006

1.7.3 Instructions: Form 2864

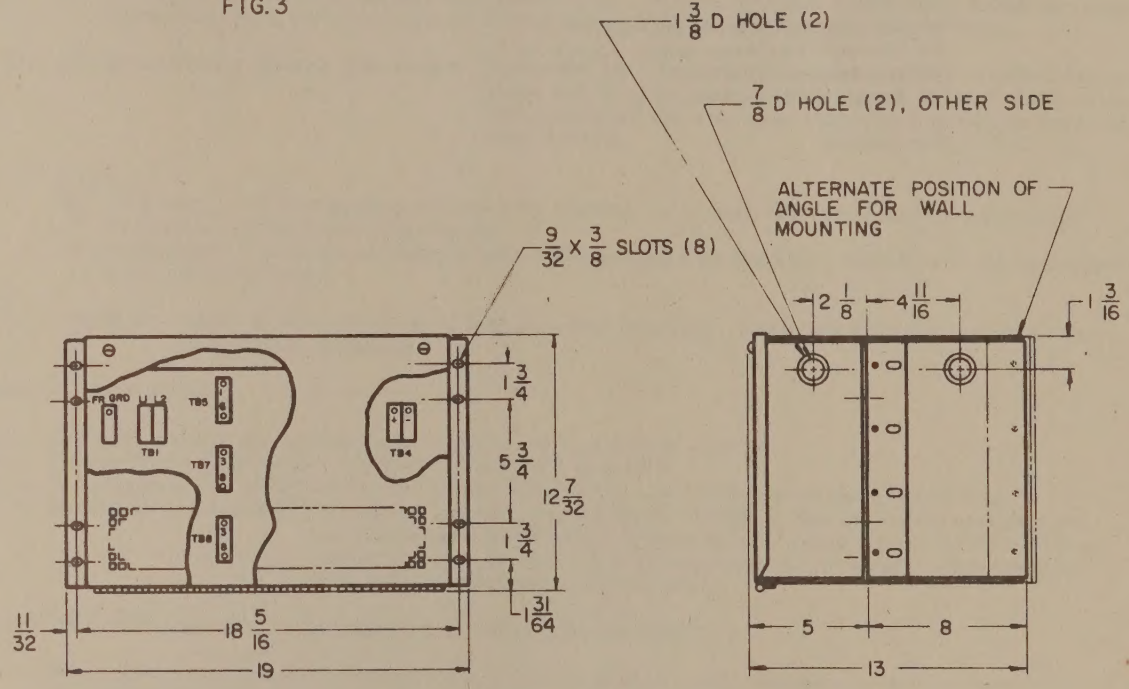
1.7.4 Curves
(A) Input Amps/Output Amps: C1938
(B) Output Volts/Output Amps: C1939
(C) Efficiency: C1940
(D) Power Factor: C1941

1.7.5 Photographs:

2. DIMENSIONS



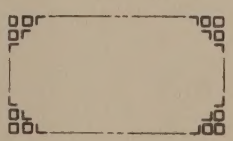
TOP VIEW
FIG. 3



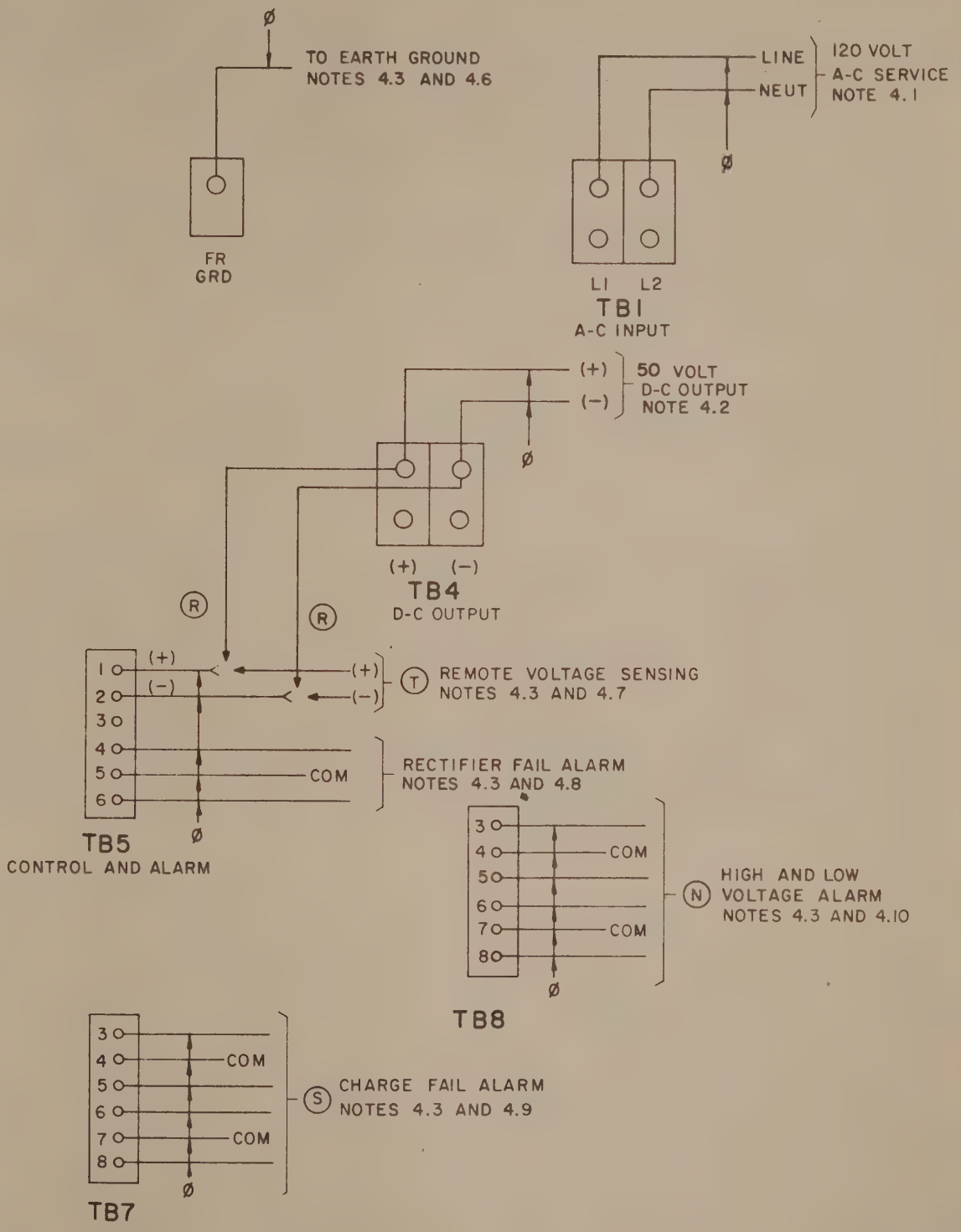
FRONT VIEW
FIG. 1

SIDE VIEW
FIG. 2

NOTES

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.
2. WEIGHT
   (A) SHIPPING, LB: 82
   (B) NET, LB: 78
3. FINISH: EQUIPMENT LIGHT GRAY.
4.  INDICATES VENTILATING GRILLE

3. INSTALLER'S CONNECTIONS



4. INSTALLER'S INFORMATION NOTES

4.1

A-C INPUT			
Term. Cap.	Voltage	Recm Wire Size	Recm Fusing
18 to 8 Ga.	120	14 Ga.	15 Amp

4.2

D-C OUTPUT		
Term. Cap.	Loop Length - Ft Note 4.4	Recm Wire Size
18 to 4 Ga.	50	10 Ga.
	100	8 Ga.

4.3

ALARM AND CONTROL		GROUND	
Term. Cap.	Recm Wire Size	Term. Cap.	Recm Wire Size
14 Ga. Max.	18 Ga.	14 Ga. to 1/0	14 Ga.

4.4 D-C output wire size sufficient to restrict voltage drop to one volt or less at rated full load output current for the loop lengths shown. The loop length is the sum of the lengths of the positive and negative leads.

4.5 Wire sizes meet those recommended in National Electric Code Table 310-12 for 75°C conductor temperature.

4.6 Connect this terminal to earth ground (green wire).

4.7 When "T" Option (remote voltage sensing leads are extended to battery or power board terminals) is furnished, negative lead should be fused at 1 ampere. Unless otherwise specified, leads are factory-connected to D-C Output terminals.

4.8 Rectifier failure is indicated by a closed circuit between terminals 4 to 5 and an open circuit between terminals 5 to 6 of terminal block TB5.

4.9 When "S" Option (see paragraph 1.6.2) is furnished, an alarm condition is indicated by closed circuits between terminals 4 to 5 and 7 to 8 and open circuits between terminals 3 to 4 and 6 to 7 of terminal block TB7.

4.10 When "N" Option (see paragraph 1.6.3) is furnished, an alarm condition is indicated by closed circuits between terminals 4 to 5 and 7 to 8 and open circuits between terminals 3 to 4 and 6 to 7 of terminal block TB8.

4.11 ϕ indicates leads run by installer.

GENERAL INSTRUCTIONS FOR 48 VOLT "L" SERIES FLOTROL RECTIFIERS

CONTENTS PAGE

1. MODEL DATA 1

2. TEST APPARATUS 1

3. DESCRIPTION 2

General 2
Accessories 2
Metering 3

4. INSTALLATION 3

Location 3
Electrical Lead Entrance ... 3
Electrical Connections 3
Input Connections 3
Output Connections 3
Extended Reference 3
Alarm Connections 4

5. ADJUSTMENTS 4

High Voltage Shutdown Adjustment 4
Accessory High-Low Voltage Alarm Assembly Adjustment 5
Output Voltage 7
Float Voltage Adjustment ... 7
Equalize Voltage Adjustment 7
Equalize Charge Timer 7
Current Limit 7

6. OPERATION 8

Starting 8
Stopping 8
Fuses 8
Alarm Indications 8

CONTENTS PAGE

Rectifier Paralleling 9
Battery Eliminator 9
Metering 9
Recharge, Equalize Charge . 9
Equalize Charge Timer Accessory 9

7. CIRCUIT DESCRIPTION 10

General 10
Input Circuit 10
Power Circuit 10
Rectifier Fail Alarm 11
RF Suppression Network 11
Voltage Regulation and Current Circuit 11
High Voltage Shutdown Circuit 11
Accessory Charge Fail Alarm Circuit 11
Accessory High-Low Voltage Alarm 12

1. MODEL DATA

1.01 Refer to Power Data Sheet for information concerning the input and output ratings, operating limits, dimensions, recommended input and output lead sizes, fusing, and terminal lug capacity.

2. TEST APPARATUS

Multimeter, Triplett Model 630A, or equivalent
Test Load, LORAIN Model Y1 (5883-101) or equivalent

3. DESCRIPTION

General

3.01 This FLOTROL Rectifier changes standard 60 Hz a-c power to direct current of suitable voltage to maintain a 23 or 24 cell battery in fully charged condition or to replace a 23 or 24 cell battery.

3.02 An input voltage range adjustment adapts this Rectifier to operate within an input range of 99 to 121 volts with the 110 volt setting selected, or 108 to 132 volts a-c with the 120 volt setting selected. If either of the two taps is applicable to the prevailing a-c line voltage, the higher voltage tap should be used in order to obtain highest power factor, lowest rectifier input current and most economical rectifier operation.

3.03 Due to a constant voltage output of this Rectifier, output current will remain equal to load current so long as load current does not exceed a predetermined (adjustable) value. This mode of operation is known as float charging. Since, in normal operation, the battery is not required to furnish load current, it remains in a fully charged condition. In this way, battery life is greatly increased.

3.04 When an a-c power failure causes battery discharge, or in event of d-c overload, an output current limiter will prevent the increase of Rectifier output current above a predetermined value.

3.05 If higher d-c voltage is required to recharge battery cells after battery discharge, or to equalize charge of all battery cells, a switch can be operated locally to obtain higher recharge or equalize charge voltage. This voltage is also adjustable, separately and independently of battery float voltage described above.

3.06 This Rectifier will shutdown, cause lamp RECTIFIER FAIL to light and extend an external alarm during a high voltage condition. If a-c power fails, it will cause lamp RECTIFIER FAIL to light and extend an external alarm.

NOTE: When used as a battery eliminator, lamp RECTIFIER FAIL will never light.

Accessories

3.07 The following accessories are available for this FLOTROL Rectifier:

a) Additional output filtering (K option) should be used when operating this Rectifier as a battery eliminator. (Refer to Para 6.10.)

b) An accessory charge fail alarm (S option) is available to extend an external alarm and cause lamp RECTIFIER FAIL to light in event output current should decrease to 1% or less of rated output current.

c) An accessory high-low voltage alarm (N option) is available to extend an external alarm and cause lamp RECTIFIER FAIL to light in event the Rectifier output voltage should go outside a preset (adjustable) range.

d) An accessory equalize timer assembly (X option) is available for use with this charger. This timer assembly will automatically restore usual float voltage after a preset interval, up to 24 hours. It is designed to mount above the charger in a 19 inch relay rack.

Metering

3.08 This Rectifier is furnished with an ammeter (M1) to indicate output current and a voltmeter (M2) to indicate output voltage.

4. INSTALLATION

Location

4.01 This FLOTROL Rectifier operates best in a well-ventilated area which has an ambient temperature range between 0°C (32°F) and 50°C (+122°F).

Electrical Lead Entrance

4.02 Input and output leads are brought through the insulated bushings on the sides of the unit.

Electrical Connections

4.03 Installer connections and terminal block location are shown on the Power Data Sheet.

Input Connections

4.04 The a-c line is connected to terminals L1 and neut. Connect nominal 110 or 120 volt, 57 to 63 Hz a-c to these terminals.

4.05 Place the tap selection (110 volt or 120 volt) to the position corresponding to the available power.

Output Connections

4.06 Output lead connections are made to the two terminal lugs at the right side of the unit. Connect leads to terminals POS (+) and NEG (-), observing correct polarity.

Extended Reference

4.07 Terminals 1 (positive) and 2 (negative) of terminal strip TB5 are reference voltage terminals which, unless otherwise specified, are factory-connected to FLOTROL Rectifier output terminals. These connections cause a voltage control circuit to regulate FLOTROL Rectifier output voltage.

4.08 In order to take full advantage of the close output voltage regulation characteristics of this FLOTROL Rectifier, the leads connecting terminals 1 and 2 to the output terminals should be disconnected and removed from the FLOTROL Rectifier. Then reference leads (user furnished) can be extended from terminals 1 and 2 to battery or power board at which d-c voltage regulation is required. If voltage drop in FLOTROL Rectifier output leads will exceed 1 volt, reference voltage leads should be extended to hold battery voltage constant.

4.09 Refer to Power Data Sheet for recommended extended reference lead fusing.

CAUTION: Polarity of reference voltage leads is critical. If necessary to extend reference voltage leads, make connections carefully to assure that polarity is correct.

Alarm Connections

4.10 The alarm connections are made to terminal strips TB5, TB7 and TB8.

a) In event of a Rectifier Fail condition, closed circuits are provided between terminals 4 and 5 of TB5, while open circuits are provided between terminals 5 and 6 of TB5.

b) If a charge fail alarm is provided, closed circuits are provided between terminals 4 to 5 and 7 to 8 of TB7, while open circuits are provided between terminals 3 to 4 and 6 to 7 of TB7 during a charge fail condition. A rectifier fail alarm will also be extended.

c) If a high-low voltage alarm is provided, closed circuits are provided between terminals 4 to 5 and 7 to 8 of TB8, while open circuits are provided between terminals 3 to 4 and 6 to 7 of TB8 during a high-low voltage condition. A rectifier fail alarm will also be extended.

5. ADJUSTMENTS

High Voltage Shutdown Adjustment

5.01 This circuit sets the value of output voltage above which the FLOTROL Rectifier will shutdown. The high voltage shutdown can be set for any voltage between 55.2 to 60 volts and has a ± 0.05 volts/cell tolerance. Should it become necessary to change this setting, use the following procedure:

a) With FLOTROL Rectifier circuit breakers (CB1 and CB2) in the OFF position, disconnect load from FLOTROL Rectifier output terminals.

b) Connect a test load to the FLOTROL Rectifier.

NOTE: It is recommended that a LORAIN Model Y1 (5883-101) Test Load Unit be used to supply the test load.

c) Turn FLOTROL Rectifier circuit breaker CB1 to the ON position.

d) Apply approximately 25% load to the FLOTROL Rectifier by turning circuit breaker CB2 to the ON position.

e) Turn R2, on circuit card HVS-A2, fully clockwise.

f) Place FLOAT-EQUALIZE switch to the EQUALIZE position and note equalize voltage setting by using voltmeter (M2). Adjust EQ ADJ potentiometer (R9) to the desired shutdown voltage. If desired shutdown voltage is reached, continue with Steps (j-n) below. If shutdown voltage cannot be obtained, continue with Steps (g-n) and disregard Steps (j and k).

g) Remove circuit card HVS-A2 and apply, from an external d-c source (capable of supplying 300 MA), the desired shutdown voltage to pins S (+) and A (-) of HVS-A2. Adjust potentiometer (R2) counterclockwise until relay (K1) energizes causing terminals D and F to close.

h) As a check, decrease the external d-c source voltage, then increase it to the desired level to insure that relay K1 releases and again energizes, causing terminals D and F to close.

i) Disconnect the external d-c source from circuit card HVS-A2 and re-insert circuit card HVS-A2 in the machine. Continue with Steps (l-n) below.

j) Slowly turn adjustment screw of R2 counterclockwise until circuit breaker CB1 trips.

NOTE: A time delay of approximately 1 minute may occur before unit is shutdown.

When CB1 trips, turn R2 slightly clockwise. Turn CB1 on; if CB1 trips after 1 minute, turn R2 slightly clockwise. If CB1 does not trip at desired voltage, turn R2 slightly counterclockwise and wait 1 minute. Repeat as necessary until desired shutdown voltage is reached.

k) As a check, turn EQ ADJ potentiometer slightly counterclockwise and throw CB1 to the ON position. Adjust EQ ADJ potentiometer to obtain the desired shutdown voltage and wait 1 minute. If shutdown does not occur at the desired voltage within the tolerance, repeat the adjustment process until shutdown occurs when desired.

l) When the adjustment is completed, readjust the EQ ADJ potentiometer to obtain original equalize voltage. Throw FLOAT-EQUALIZE switch to the FLOAT position.

m) With FLOTROL Rectifier turned off, disconnect the test load from FLOTROL Rectifier output terminals.

n) Reconnect load and turn FLOTROL Rectifier on.

Accessory High-Low Voltage Alarm Assembly Adjustment - HLVA-A3

5.02 If a high-low voltage alarm assembly is provided, potentiometers R1306 and R1309 on plug-in card A3 set the voltage values at which the respective low and high voltage alarms are given. When alarm voltages are not specified on original order, potentiometer R1306 is adjusted to give an external alarm when battery voltage drops to approximately 2.05 volts per cell. Similarly, potentiometer R1309 is adjusted to give an alarm at approximately 2.30 volts per cell. These adjustments are performed at the factory, and no further adjustments should be required.

5.03 If it becomes necessary to change either of the alarm voltage settings, the following procedure should be followed. To adjust the value at which the low voltage alarm is given:

a) With FLOTROL Rectifier turned off, disconnect load from FLOTROL Rectifier output terminals.

b) Connect a test load to the FLOTROL Rectifier.

c) Turn FLOTROL Rectifier on.

d) Apply approximately 25% load to FLOTROL Rectifier.

e) Turn screwdriver adjustment R1306 fully counterclockwise and R1309 fully clockwise. With the high-low voltage alarm card and relay installed in their respective

sockets, set the output voltage by means of potentiometer FLT ADJ to the value at which the low voltage alarm is desired. (Before readjusting the FLT ADJ potentiometer, note the float voltage setting of the FLOTROL Rectifier so that it may be reset to its original value after the low voltage adjustment has been made.)

f) Connect an ohmmeter between terminals 4 and 5 of TB8. With R1306 fully counterclockwise, the ohmmeter should indicate an open circuit.

g) Turn R1306 in a clockwise direction until the ohmmeter indicates a short circuit.

h) Increase the FLOTROL Rectifier output voltage by means of potentiometer FLT ADJ until the ohmmeter indicates an open circuit. Decrease the output voltage noting at what voltage the ohmmeter indicates a short circuit. If the ohmmeter indicates a short circuit at a lower or higher voltage than desired, turn R1306 slightly clockwise or counterclockwise, respectively, until the ohmmeter indicates a short circuit at the desired voltage.

i) Readjust the FLT-ADJ potentiometer to obtain the original float voltage setting.

j) With FLOTROL Rectifier turned off, disconnect the test load from the FLOTROL Rectifier output terminals.

k) Reconnect load and turn FLOTROL Rectifier on.

5.04 To adjust the value at which the high voltage alarm is given:

a) With FLOTROL Rectifier turned off, disconnect load from FLOTROL Rectifier output terminals.

b) Connect a test load to the FLOTROL Rectifier.

NOTE: It is recommended that a LORAIN Model Y1 (5883-101) Test Load Unit be used to supply the test load.

c) Turn the FLOTROL Rectifier on and apply approximately 25% load. Throw the FLT-EQ switch to the EQ position and note the equalize voltage setting. Adjust the EQ ADJ potentiometer for the desired alarm voltage. If the alarm voltage setting is reached, proceed with Steps (g-l). If the desired voltage cannot be obtained with the EQ ADJ potentiometer fully clockwise, proceed with Steps (d-f).

d) Remove circuit card HLVA-A3. From an external d-c source (capable of supplying 300 MA), supply the desired voltage to pins S (+) and A (-) of circuit card HLVA-A3. Connect a 48VDC relay between pins M and K. Connect an ohmmeter across relay contacts 1 and 9. The ohmmeter should read an open circuit. Adjust potentiometer R1309 counterclockwise until the ohmmeter indicates a short circuit at the desired voltage.

e) As a check, decrease the external d-c source voltage and then increase it again to desired alarm level to insure that relay K1 drops out to provide a short circuit across relay contacts 1 and 9.

f) Remove the external d-c source from circuit card HLVA-A3, reinsert the circuit card into the unit and proceed with Steps (j-l).

g) Connect an ohmmeter across TB8 terminals 4 and 5. With R1309 fully clockwise, the ohmmeter should indicate an open circuit.

h) Turn R1309 counterclockwise until the ohmmeter indicates a short circuit.

i) Reduce the FLOTROL Rectifier output voltage until the ohmmeter indicates an open circuit. Increase the FLOTROL Rectifier output voltage noting at what voltage the ohmmeter indicates a short circuit. If the ohmmeter indicates a short circuit at a lower or higher voltage than desired, turn R1309 slightly clockwise or counterclockwise, respectively, until the ohmmeter indicates a short circuit at the desired voltage.

j) Readjust both the original float and equalize voltage settings.

k) With FLOTROL Rectifier turned off, disconnect the test load from FLOTROL Rectifier output terminals.

l) Reconnect load and turn FLOTROL Rectifier on.

Output Voltage

5.05 The output voltage of this FLOTROL Rectifier is factory adjusted to float 23 cells of a lead-acid battery at 2.17 volts per cell, and equalize the battery at 2.35 volts per cell.

Float Voltage Adjustment

5.06 Potentiometer FLT ADJ (R8), located on the front meter panel, adjusts the output voltage of the Rectifier when the FLT-EQ switch is in the FLT position. Turning the potentiometer shaft clockwise increases the float output voltage of the Rectifier.

Equalize Voltage Adjustment

5.07 Potentiometer EQ ADJ (R9), located on the front meter panel, adjusts the output voltage of the Rectifier when the FLT-EQ switch is in the EQ position. Turning the potentiometer shaft clockwise increases the equalize output voltage of the Rectifier.

Equalize Charge Timer

5.08 When an accessory equalize charge timer is installed, it can be adjusted up to 24 hours (recommended minimum setting 2-1/2 hours). If the equalize charge period was specified on the order, it has been set as required. If no equalize charge period was specified, it has been set at 4 hours.

5.09 To adjust the equalize timer, turn the dial counterclockwise so that the desired equalize charge period is aligned opposite index marker.

Current Limit

5.10 The value at which the output current limiter circuit will prevent

further increase of output current is set by means of potentiometer CURRENT LIMIT R3 located on circuit card RC-A1. Potentiometer R3 can be set to limit the output current at any value between approximately 90% and 125% of its rated value. The current limit setting is factory adjusted to 110% of the rectifier's rated value. Turning the control clockwise increases the value at which the Rectifier will limit its output current.

6. OPERATION

Starting

6.01 Connect a-c input to terminals L1 and neut as explained in Para 4.04.

6.02 Connect nominal 50 volt d-c load to output terminals positive (+) and negative (-), observing correct polarity.

6.03 Close output circuit breaker CB2. Lamp RECTIFIER FAIL (when used as a battery charger) should light.

6.04 Close input circuit breaker CB1. Lamp RECTIFIER FAIL should extinguish and lamp POWER ON should light. The FLOTROL Rectifier is now supplying power to the load.

Stopping

6.05 Open circuit breakers CB2 and CB1. Lamp POWER ON should extinguish and lamp RECTIFIER FAIL (when used as a battery charger) should light.

Fuses

6.06 Fuse F1 supplies power to the voltage and current regulator circuit card. In event the fuse should open, replace with Bussmann Type AGC-3/4, 3/4 ampere.

Alarm Indications

6.07 This Rectifier provides certain alarm indications whenever an abnormal condition exists. These are listed below according to the type of malfunction.

a) High Voltage Shutdown: Lamp POWER ON will extinguish, lamp RECTIFIER FAIL will light (when used as a battery charger), circuit breaker CB1 will be in the OFF position and an external alarm will be extended. To reset CB1, throw the toggle to the ON position.

b) Charge Fail Alarm (if provided): Lamp RECTIFIER FAIL will light and an external alarm will be extended in event the output current should decrease to 1% or less of rated output current. When output current increases to 2% of rated output current, lamp RECTIFIER FAIL will go out and the external alarm will be extinguished.

c) High-Low Voltage Alarm (if provided): An external alarm will be extended and lamp RECTIFIER FAIL will light in event that the output voltage should go outside a preset range. When the output voltage is again within the correct range, all alarm indications will be cancelled.

Rectifier Paralleling

6.08 This FLOTROL Rectifier is equipped with an automatic current limiting circuit. This circuit will enable the paralleling of this FLOTROL Rectifier with any other battery charger which can be adjusted to the same output voltage. The load may not be shared proportionally but when this FLOTROL Rectifier reaches its current limit setting, it will not deliver further current and any additional load must be supplied by the other paralleled battery charger(s).

NOTE: When two or more Rectifiers are operating in parallel, set the current limit (Para 5.07) to 100%. This will prevent the Rectifier from being damaged during an overload or short circuit condition.

Battery Eliminator

6.09 When this Rectifier is used as a battery eliminator (replaces 23 or 24 cell batteries), additional filtering K option and wiring option M on circuit card RC-A1 must be connected. Refer to schematic diagram.

Metering

6.10 This FLOTROL Rectifier is equipped with an ammeter (M1) to indicate output current and a voltmeter (M2) to indicate output voltage.

Recharge, Equalize Charge

6.11 Higher d-c voltage is sometimes required to recharge discharged battery cells, or to equalize charge of all battery cells. To obtain this voltage from the FLOTROL Rectifier, throw toggle of FLT-EQ switch to EQ position; to restore usual battery float operation, throw toggle to FLT position. Any time the Rectifier is in equalize charge, white lamp EQ will be illuminated.

NOTE: When the output of this FLOTROL Rectifier is in parallel with the output of other Rectifier(s), all Rectifiers should be operating in the same mode (Float or Equalize). For example, with (3) Rectifiers operating in parallel, putting Rectifier #1 into the equalize mode could cause the other two Rectifiers to give an alarm indication. This is because the Rectifier in the equalize mode is possibly supplying the total load current. Therefore, be sure that all parallel connected Rectifiers are operating in the same mode and at the same output voltage.

Equalize Charge Timer Accessory

6.12 When an equalize charge timer is to be used to time an equalize charge period, the following procedure should be followed:

a) To operate the equalize timer, turn the dial counterclockwise so that the desired equalize charge period is aligned opposite index marker (dial settings are in 1 hour increments from 0-24 hours). The dial will remain at its time setting throughout the equalize charge period.

b) Place the FLT/EQ switch to the EQ position and the timer will operate.

NOTE: Do not try to readjust the dial setting of the timer during an equalize charge period. It is only adjustable during float operation with the FLT/EQ switch in the FLT position.

c) When the equalize charge period expires, the Rectifier will automatically resume float operation. (FLT/EQ switch will remain in the EQ position.)

d) The FLT/EQ switch should be manually returned to the FLT position after the equalize charge period has expired.

6.13 If it is desired to resume float operation before an equalize charge period is over, just return the FLT/EQ switch to the FLT position. When this is done, the timer will automatically reset.

6.14 In event of an a-c power failure during the equalize charging period, the timer will reset and complete its entire timing cycle when the a-c service is restored.

7. CIRCUIT DESCRIPTION

General

7.01 The purpose of this circuit is to provide isolated, filtered and regulated d-c power from a single-phase a-c source for automatically charging and floating 23 or 24 cell batteries or as a battery eliminator.

Input Circuit

7.02 Capacitors C23 and C24 provide RF suppression. The current coil of CB1 is placed in series with the input line. The input line will be opened when either excessive input current is sensed or the high voltage shutdown circuit HVS-A2 detects a high output voltage and places the voltage coil of CB1 across the input line, causing it to trip.

7.03 Terminals of TB2 are used to adjust the primary of T1 to the prevailing a-c line. Lamp DS3 will be illuminated whenever input voltage is applied, and CB1 is closed.

Power Circuit

7.04 Triac CR1, inductor L1, capacitor C1 on the (R-W, Blk) winding of T1 and the primary winding of T1 function to control the power circuit output voltage. Signals from a pulse circuit determine the length of time that the triac is turned on (phaseback angle). Whenever the triac is conducting, choke L1 is in parallel with capacitor C1. A variation in the phaseback angle of the firing of the triac changes the impedance of this circuit. This change in impedance will cause the current in the (R-W, Blk) winding to change in both magnitude and phase. The change in magnitude and phase of current in the secondaries of T1 will affect the primary current and will maintain a constant output voltage on the (Br-Y) winding of T1.

7.05 The voltage on the primary of T1 is equal to the resultant of the a-c line voltage and the voltage developed across the equivalent series inductance of T1 primary. If, in effect the phase a and magnitude of the voltage across the equivalent of the voltage across the equivalent inductance of T1 primary can be controlled with respect to a-c line, then the primary voltage and hence the

output voltage of the unit can be kept constant regardless of variations in line voltage, line frequency or load.

7.06 The power secondary winding of the main transformer T1 (Br, Y) winding is connected to the power rectifier stack in a center-tapped arrangement using silicon diodes. The output from this stack is smoothed by the filter capacitors C5 and C6 and inductor L2. Capacitor C11 provides additional filtering when this unit is used as a battery eliminator. Bleeder resistor R3 discharges the filter capacitor when this unit is turned off and not connected to a battery.

Rectifier Fail Alarm

7.07 Relay K2 is energized when the output of the FLOTROL Rectifier is correct, If, for any reason, the output of the Rectifier is absent, relay K2 releases and causes lamp RECT FAIL to light. Other contacts of K2 provide external alarms, if connected.

RF Suppression Network

7.08 The output circuit of the FLOTROL Rectifier is provided with RF suppression networks composed of capacitors C33, C34 and choke L30, and capacitors C35, C36, and C38 - C41.

Voltage Regulation and Current Circuit (RC-A1)

7.09 This circuit compares output voltage with a reference voltage to provide to the pulse circuit an error signal representing the polarity and magnitude of the difference, and limits the output current to an adjustable value.

7.10 The voltage and current regulating functions are essentially separate from each other, each having its own amplification constant and its own stabilizing network. The voltage regulation function is performed by A2, the current regulation is performed by A1. The outputs of A1 and A2 are combined through diodes CR1 and CR10 and fed to the pulse circuit. Whichever circuit is operating at any instant controls the pulse circuit.

7.11 The CUR LIM ADJ potentiometer (R3) varies the value of current limit since a higher value of resistance changes the ratio of the voltage between the reference voltage and the current amplifier (A1) output such that a higher positive output from A1 and thus a lower rectifier load current is required to initiate current limiting. The opposite occurs with a decrease in resistance of the CUR LIM ADJ potentiometer.

High Voltage Shutdown Circuit (HVS-A2)

7.12 This circuit determines the value of output voltage above which the Rectifier shuts down. Normal output voltage across pins A and S of this circuit bias transistor Q1 at cutoff. Potentiometer R2 sets the base voltage at a specific value. If output voltage should increase, transistor Q1 will conduct, allowing current flow through the coil of relay K1. K1, energized, will close contacts of itself, shorting the voltage contacts of input circuit breaker CB1, causing it to trip. With input power interrupted, the Rectifier is now turned off and must be manually reset.

Accessory Charge Fail Alarm Circuit (CFA-A4)

7.13 This circuit senses a small voltage developed across ammeter M1.

This voltage is proportional to output current. This voltage is amplified and compared to a constant voltage. The difference of these two voltages is then amplified to control the operation of transistor Q1. Under normal conditions, Q1 is conducting, allowing current flow through the coil of relay K1, keeping it energized. If, however, the output current should decrease to 1% or less of its rated output, not enough voltage is developed to keep Q1 in conduction. The cutoff of Q1 will de-energize relay K1 and it will extend an alarm.

Accessory High-Low Voltage Alarm (HLVA-A3)

7.14 If a high-low voltage alarm relay is provided, it releases to extend an external alarm when battery voltage either increases or decreases to preset values.

7.15 Two voltage sensing networks compare a portion of the battery voltage with a constant voltage developed in the high-low voltage alarm circuit. Should the battery voltage decrease to value determined by the setting of potentiometer R1306 or increase to value determined by the setting of potentiometer R1309, relay K1 releases to close circuits between terminal strip TB8 terminals 4 to 5 and 7 to 8, respectively, open circuits between TB8 terminals 3 to 4 and 6 to 7, respectively, and light a red RECT FAIL lamp.

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TROUBLESHOOTING INSTRUCTIONS

LORAIN "L" SERIES, SINGLE PHASE FLOTROL RECTIFIERS

General

These troubleshooting instructions consist of two separate sections which, when used together, should help isolate failures in the Rectifier.

The first section is a "branch-type" trouble chart which makes use of the various Rectifier alarm lamps to rapidly isolate the trouble condition to the most probable trouble causes.

The second section of the troubleshooting procedure contains specific repair procedures referenced on the "branch-type" trouble chart.

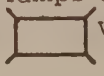
Whenever a specific repair procedure number is listed on the "branch-type" trouble chart, proceed to the repair procedure in section two which corresponds to the repair procedure number given on the "branch-type" trouble chart.

EXPLANATION OF RECTIFIER TROUBLE CHART

The "branch-type" trouble charts, which follow, help isolate Rectifier malfunctions by use of various equipment alarm lamps. By observing the various alarm lamps which are illuminated, the trouble condition can be rapidly isolated to the most probable causes. Two trouble charts are included in these troubleshooting instructions. Use the chart which agrees with the model Rectifier in service.

An explanation of how to use this chart in isolating trouble is given below.

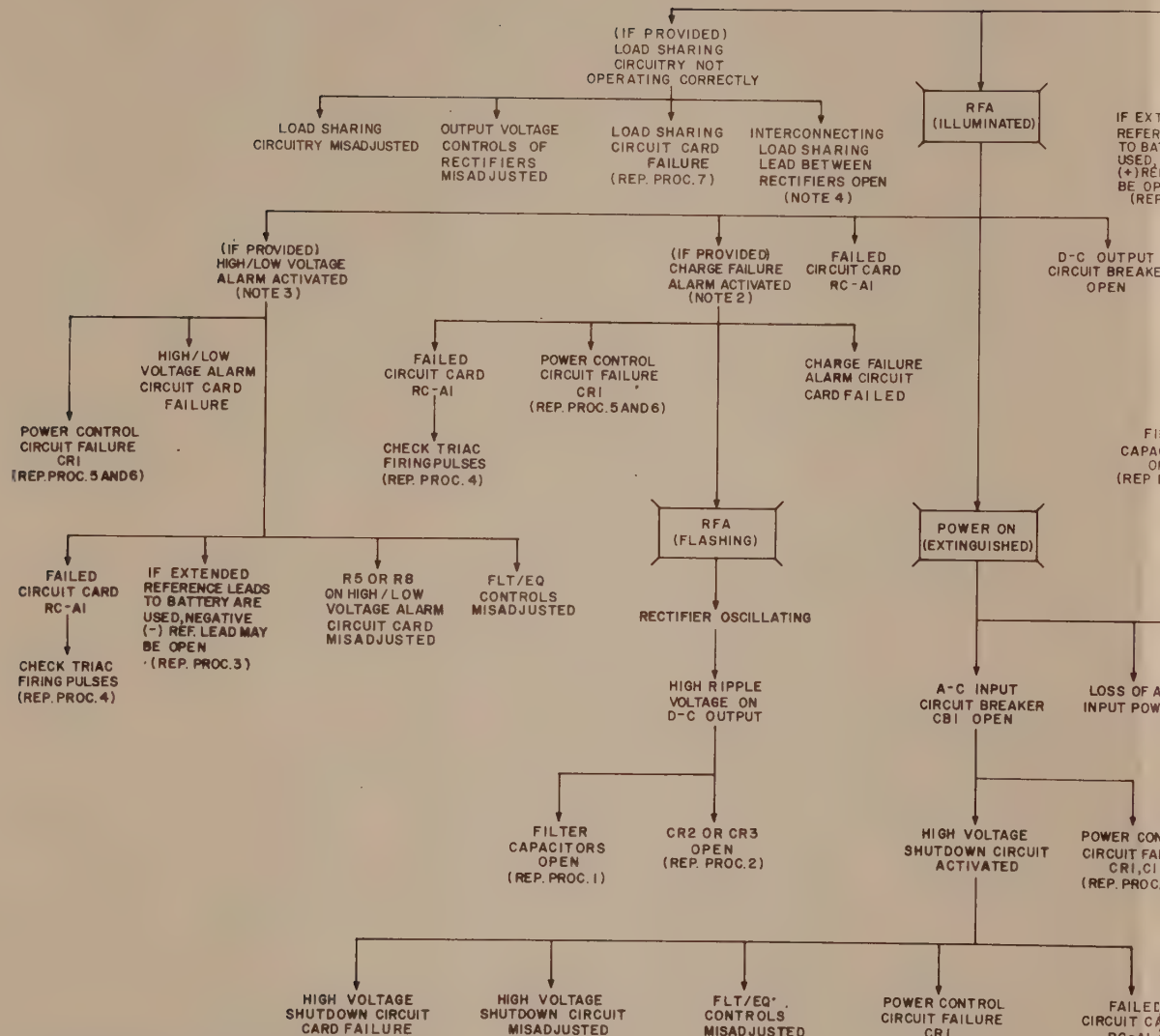
(1) The chart should be read from the top to the bottom; that is, in the direction of the arrows. A trouble symptom, indicated by a visual alarm and/or an irregular Rectifier operating condition, is followed by the most probable causes for the problem.

NOTE: All lamps used on the trouble chart are represented by the symbol  with the lamp designation enclosed in the symbol.

(2) When the trouble is isolated down to a plug-in printed circuit card, the card should be replaced. No attempt should be made to troubleshoot or repair the circuit cards.

(3) If the trouble is suspected to be caused by an out of adjustment condition, the adjustment setting should be checked using the adjustment procedure in the respective instruction manual.

(4) Certain trouble conditions may require no specific check procedures (e.g., open fuses), therefore, no additional information is given. If a specific procedure is required to check certain trouble conditions, a repair procedure number on the chart will reference to a specific repair procedure contained in the Rectifier Repair Procedures section of these troubleshooting instructions.


(IF PROVIDED) LOAD SHARING CIRCUITRY NOT OPERATING CORRECTLY
LOAD SHARING CIRCUITRY MISADJUSTED
OUTPUT VOLTAGE CONTROLS OF RECTIFIERS MISADJUSTED
LOAD SHARING CIRCUIT CARD FAILURE (REP. PROC. 7)
INTERCONNECTING LOAD SHARING LEAD BETWEEN RECTIFIERS OPEN (NOTE 4)
RFA (ILLUMINATED)
(IF PROVIDED) HIGH/LOW VOLTAGE ALARM ACTIVATED (NOTE 3)
(IF PROVIDED) CHARGE FAILURE ALARM ACTIVATED (NOTE 2)
FAILED CIRCUIT CARD RC-AI
D-C OUTPUT CIRCUIT BREAKE OPEN
HIGH/LOW VOLTAGE ALARM CIRCUIT CARD FAILURE
POWER CONTROL CIRCUIT FAILURE CRI (REP. PROC. 5 AND 6)
FAILED CIRCUIT CARD RC-AI
CHECK TRIAC FIRING PULSES (REP. PROC. 4)
POWER CONTROL CIRCUIT FAILURE CRI (REP. PROC. 5 AND 6)
CHARGE FAILURE ALARM CIRCUIT CARD FAILED
RFA (FLASHING)
POWER ON (EXTINGUISHED)
FAILED CIRCUIT CARD RC-AI
CHECK TRIAC FIRING PULSES (REP. PROC. 4)
IF EXTENDED REFERENCE LEADS TO BATTERY ARE USED, NEGATIVE (-) REF. LEAD MAY BE OPEN (REP. PROC. 3)
R5 OR R8 ON HIGH/LOW VOLTAGE ALARM CIRCUIT CARD MISADJUSTED
FLT/EQ CONTROLS MISADJUSTED
RECTIFIER OSCILLATING
HIGH RIPPLE VOLTAGE ON D-C OUTPUT
A-C INPUT CIRCUIT BREAKER CB1 OPEN
FILTER CAPACITORS OPEN (REP. PROC. 1)
CR2 OR CR3 OPEN (REP. PROC. 2)
HIGH VOLTAGE SHUTDOWN CIRCUIT ACTIVATED
HIGH VOLTAGE SHUTDOWN CIRCUIT CARD FAILURE
HIGH VOLTAGE SHUTDOWN CIRCUIT MISADJUSTED
FLT/EQ CONTROLS MISADJUSTED
POWER CONTROL CIRCUIT FAILURE CRI (REP. PROC. 5)

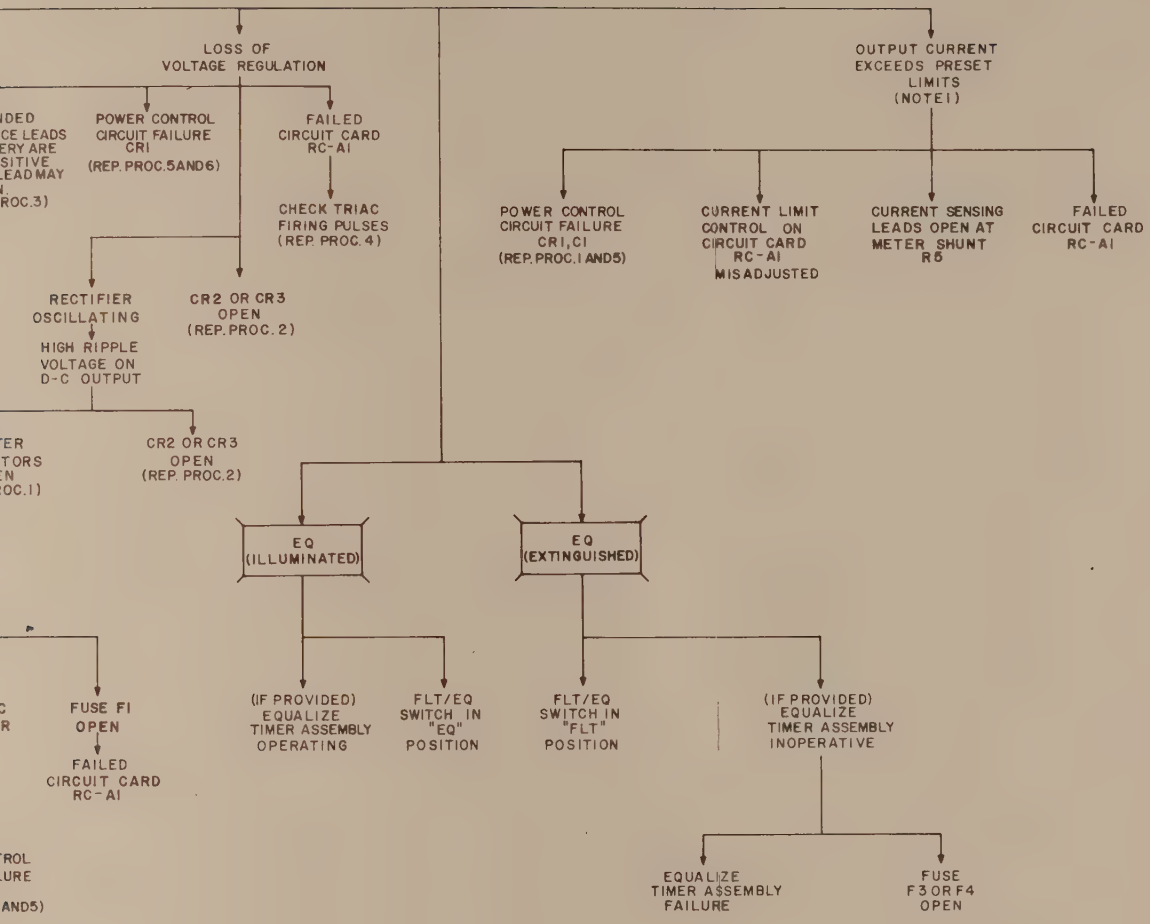
RECTIFIER OPERATING CONDITION NOTES:

1. CURRENT LIMIT IS FACTORY ADJUSTED TO 110% OF RATED OUTPUT UNLESS OTHERWISE SPECIFIED.
2. IN EVENT OF A CHARGE FAIL CONDITION, AN EXTERNAL ALARM MAY BE ACTIVATED THROUGH CLOSED CIRCUITS PROVIDED BETWEEN TERMINALS 4 TO 5 AND 7 TO 8 OF TB7 OR THROUGH OPEN CIRCUITS PROVIDED BETWEEN TERMINALS 3 TO 4 AND 6 TO 7 OF TB7.
3. IN EVENT OF A HIGH OR LOW VOLTAGE CONDITION, AN EXTERNAL ALARM MAY BE ACTIVATED THROUGH CLOSED CIRCUITS PROVIDED BETWEEN TERMINALS 4 TO 5 AND 7 TO 8 OF TB8 OR THROUGH OPEN CIRCUITS PROVIDED BETWEEN TERMINALS 3 TO 4 AND 6 TO 7 OF TB8.
4. IF THE LOAD SHARING OPTION IS FURNISHED, A PARALLELING LEAD IS CONNECTED FROM TERMINAL 3 OF TB5 TO OTHER PARALLELED RECTIFIERS EQUIPPED WITH SIMILAR LOAD SHARING CIRCUITRY.

TROUBLE

THIS CHART AP
FOLLOWING REC

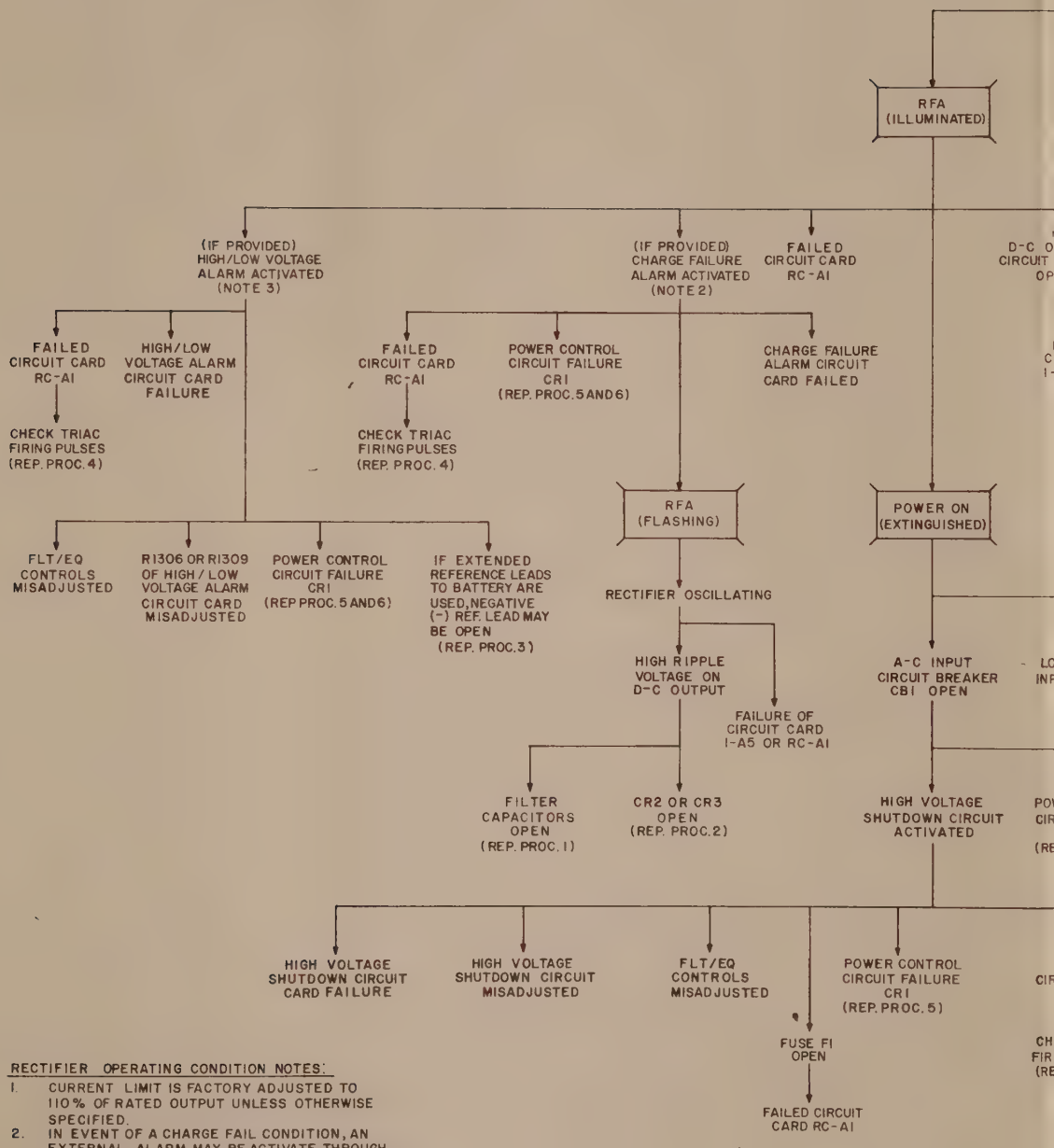
L20F50
L30F25
L30F50
L50F25
L50F50


LOSS OF VOLTAGE REGULATION
POWER CONTROL CIRCUIT FAILURE CR1 (REP. PROC. 5 AND 6)
FAILED CIRCUIT CARD RC-A1
CHECK TRIAC FIRING PULSES (REP. PROC. 4)
RECTIFIER OSCILLATING
HIGH RIPPLE VOLTAGE ON D-C OUTPUT
CR2 OR CR3 OPEN (REP. PROC. 2)
CR2 OR CR3 OPEN (REP. PROC. 2)
OUTPUT CURRENT EXCEEDS PRESET LIMITS (NOTE 1)
POWER CONTROL CIRCUIT FAILURE CR1, C1 (REP. PROC. 1 AND 5)
CURRENT LIMIT CONTROL ON CIRCUIT CARD RC-A1 MISADJUSTED
CURRENT SENSING LEADS OPEN AT METER SHUNT R5
FAILED CIRCUIT CARD RC-A1
EQ (ILLUMINATED)
EQ (EXTINGUISHED)
FUSE F1 OPEN
FAILED CIRCUIT CARD RC-A1
(IF PROVIDED) EQUALIZE TIMER ASSEMBLY OPERATING
FLT/EQ SWITCH IN "EQ" POSITION
FLT/EQ SWITCH IN "FLT" POSITION
(IF PROVIDED) EQUALIZE TIMER ASSEMBLY INOPERATIVE
EQUALIZE TIMER ASSEMBLY FAILURE
FUSE F3 OR F4 OPEN

CHART

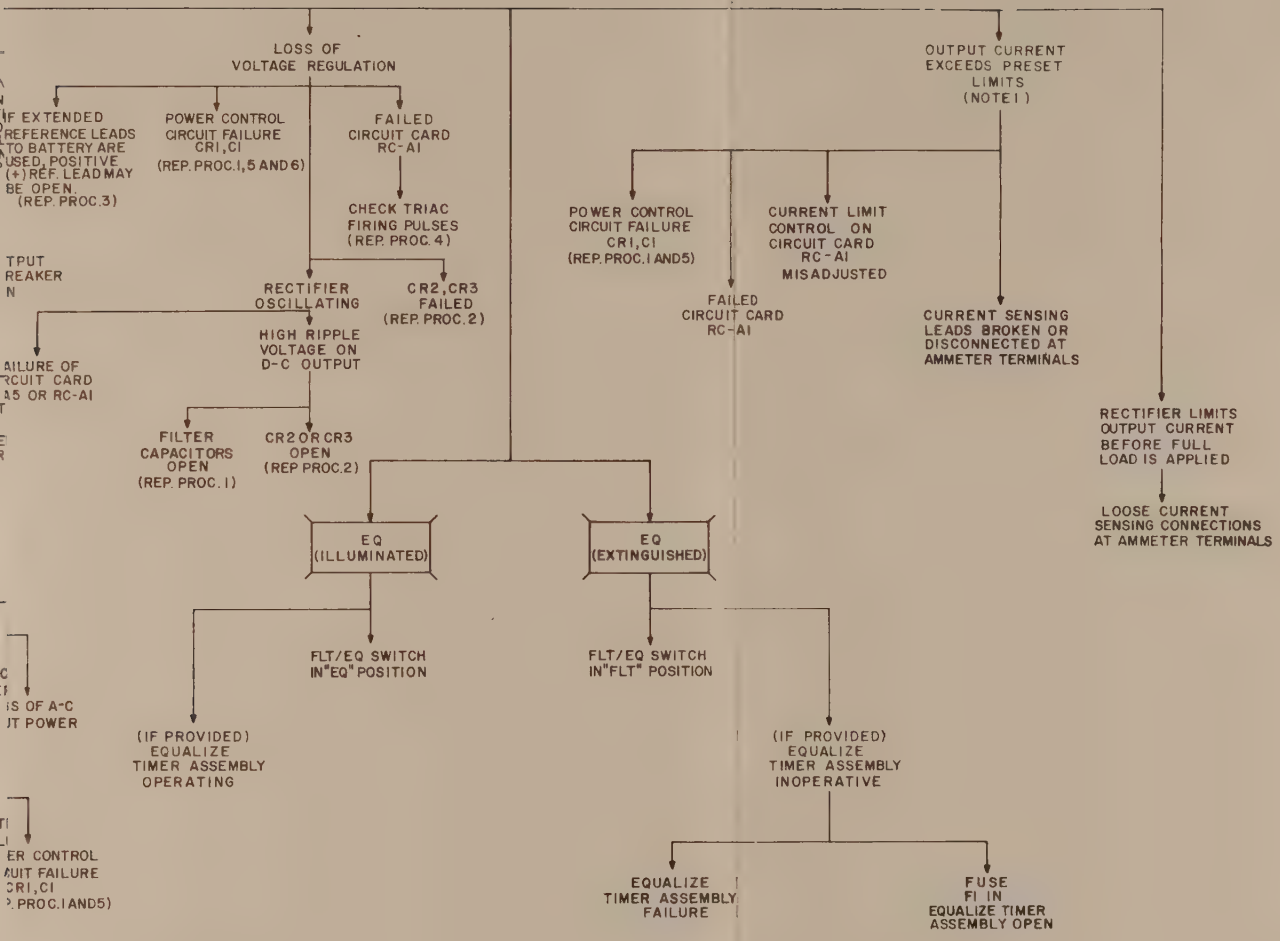
PLIES TO THE
TIFIER MODELS.

L100F25
L100F50
L150F25
L200F25


RFA (ILLUMINATED)
(IF PROVIDED) HIGH/LOW VOLTAGE ALARM ACTIVATED (NOTE 3)
(IF PROVIDED) CHARGE FAILURE ALARM ACTIVATED (NOTE 2)
FAILED CIRCUIT CARD RC-AI
D-C O CIRCUIT OP
FAILED CIRCUIT CARD RC-AI
HIGH/LOW VOLTAGE ALARM CIRCUIT CARD FAILURE
CHECK TRIAC FIRING PULSES (REP. PROC. 4)
FAILED CIRCUIT CARD RC-AI
POWER CONTROL CIRCUIT FAILURE CRI (REP. PROC. 5 AND 6)
CHARGE FAILURE ALARM CIRCUIT CARD FAILED
CHECK TRIAC FIRING PULSES (REP. PROC. 4)
RFA (FLASHING)
POWER ON (EXTINGUISHED)
FLT/EQ CONTROLS MISADJUSTED
R1306 OR R1309 OF HIGH/LOW VOLTAGE ALARM CIRCUIT CARD MISADJUSTED
POWER CONTROL CIRCUIT FAILURE CRI (REP PROC. 5 AND 6)
IF EXTENDED REFERENCE LEADS TO BATTERY ARE USED, NEGATIVE (-) REF. LEAD MAY BE OPEN (REP. PROC. 3)
RECTIFIER OSCILLATING
HIGH RIPPLE VOLTAGE ON D-C OUTPUT
A-C INPUT CIRCUIT BREAKER CB1 OPEN
FAILURE OF CIRCUIT CARD 1-A5 OR RC-AI
FILTER CAPACITORS OPEN (REP. PROC. 1)
CR2 OR CR3 OPEN (REP. PROC. 2)
HIGH VOLTAGE SHUTDOWN CIRCUIT ACTIVATED
HIGH VOLTAGE SHUTDOWN CIRCUIT CARD FAILURE
HIGH VOLTAGE SHUTDOWN CIRCUIT MISADJUSTED
FLT/EQ CONTROLS MISADJUSTED
POWER CONTROL CIRCUIT FAILURE CRI (REP. PROC. 5)
FUSE F1 OPEN
FAILED CIRCUIT CARD RC-AI

RECTIFIER OPERATING CONDITION NOTES:

1. CURRENT LIMIT IS FACTORY ADJUSTED TO 110% OF RATED OUTPUT UNLESS OTHERWISE SPECIFIED.
2. IN EVENT OF A CHARGE FAIL CONDITION, AN EXTERNAL ALARM MAY BE ACTIVATE THROUGH CLOSED CIRCUITS PROVIDED BETWEEN TERMINALS 4 TO 5 AND 7 TO 8 OF TB7 OR THROUGH OPEN CIRCUITS PROVIDED BETWEEN TERMINALS 3 TO 4 AND 6 TO 7 OF TB7.
3. IN EVENT OF A HIGH OR LOW VOLTAGE CONDITION, AN EXTERNAL ALARM MAY BE ACTIVATED THROUGH CLOSED CIRCUITS PROVIDED BETWEEN TERMINALS 4 TO 5 AND 7 TO 8 OF TB8 OR THROUGH OPEN CIRCUITS PROVIDED BETWEEN TERMINALS 3 TO 4 AND 6 TO 7 OF TB8


LOSS OF VOLTAGE REGULATION
IF EXTENDED REFERENCE LEADS TO BATTERY ARE USED, POSITIVE (+) REF. LEAD MAY BE OPEN. (REP. PROC. 3)
POWER CONTROL CIRCUIT FAILURE CR1, C1 (REP. PROC. 1, 5 AND 6)
FAILED CIRCUIT CARD RC-A1
CHECK TRIAC FIRING PULSES (REP. PROC. 4)
RECTIFIER OSCILLATING
CR2, CR3 FAILED (REP. PROC. 2)
HIGH RIPPLE VOLTAGE ON D-C OUTPUT
FILTER CAPACITORS OPEN (REP. PROC. 1)
CR2 OR CR3 OPEN (REP PROC. 2)
EQ (ILLUMINATED)
EQ (EXTINGUISHED)
FLT/EQ SWITCH IN "EQ" POSITION
FLT/EQ SWITCH IN "FLT" POSITION
(IF PROVIDED) EQUALIZE TIMER ASSEMBLY OPERATING
(IF PROVIDED) EQUALIZE TIMER ASSEMBLY INOPERATIVE
EQUALIZE TIMER ASSEMBLY FAILURE
FUSE F1 IN EQUALIZE TIMER ASSEMBLY OPEN
OUTPUT CURRENT EXCEEDS PRESET LIMITS (NOTE 1)
POWER CONTROL CIRCUIT FAILURE CR1, C1 (REP. PROC. 1 AND 5)
CURRENT LIMIT CONTROL ON CIRCUIT CARD RC-A1 MISADJUSTED
FAILED CIRCUIT CARD RC-A1
CURRENT SENSING LEADS BROKEN OR DISCONNECTED AT AMMETER TERMINALS
RECTIFIER LIMITS OUTPUT CURRENT BEFORE FULL LOAD IS APPLIED
LOOSE CURRENT SENSING CONNECTIONS AT AMMETER TERMINALS

JBLE CHART

RT APPLIES TO THE
IG RECTIFIER MODELS:

50 L12A50
25 L20A25

RECTIFIER REPAIR PROCEDURES

These repair procedures are referenced by number on the associated trouble chart. When the trouble chart identifies a repair procedure, refer immediately to the numbered repair procedure for component test and circuit repair instructions.

The Repair Procedures given below are made with the unit under test disconnected from any power source, unless specifically stated otherwise in the test procedure.

Failed components may sometimes be found by a visual inspection of the Rectifier circuitry. Obvious signs of trouble such as loose connections, overheated, discolored, or burned components, or burned and melted wire insulation should be corrected and thoroughly checked before proceeding with more detailed test and repair procedures.

Since it may be possible to locate a failed component without disconnecting it from the circuit, check each suspected component in the unit before disconnecting any leads. If the trouble cannot be determined in this manner, disconnect the leads and recheck the component. Replace any failed components.

As an identification aid, semiconductor device outlines are provided so that identification of various semiconductor terminations may easily be made.

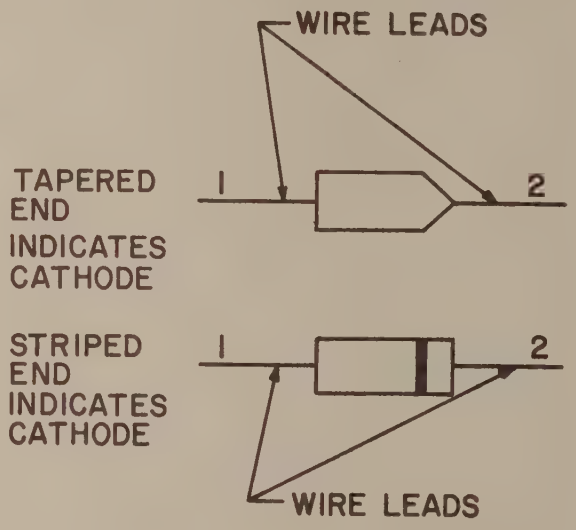
The test apparatus required to perform these repair procedures is given below:

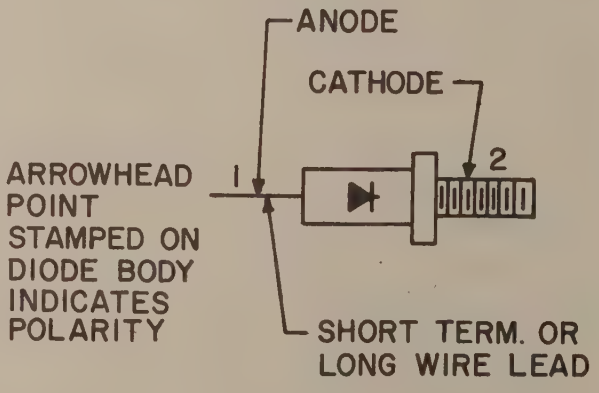
1	Multimeter, Triplett Model 630A, or equivalent
1	Oscilloscope, Hewlett-Packard Model 120B, or equivalent

WARNING: Do not connect grounded test equipment to any live component. This could result in damage to the equipment under test. At the same time, a personnel shock hazard exists since the chassis and case of ungrounded test equipment "floats" at a potentially dangerous voltage level above ground. Servicing personnel must exercise caution that they do not contact the test equipment chassis or case and some grounded object at the same time when the test equipment is connected to an operating Rectifier.

SEMICONDUCTOR IDENTIFICATION OUTLINES

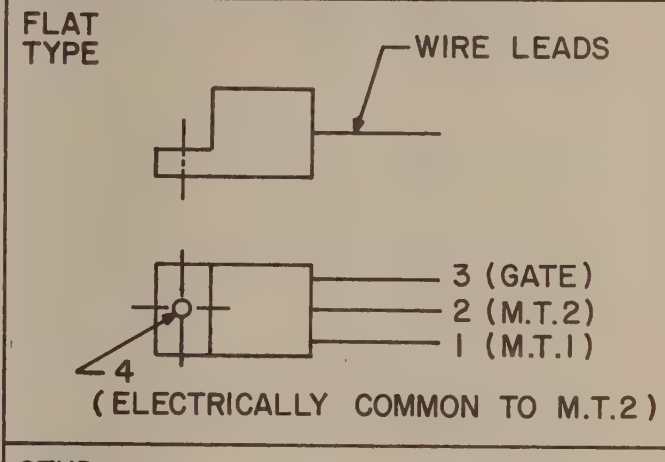
DIODES

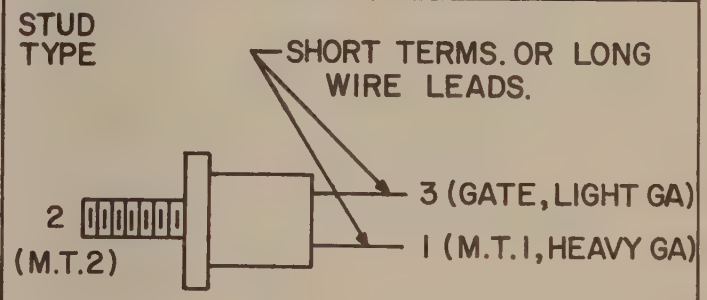


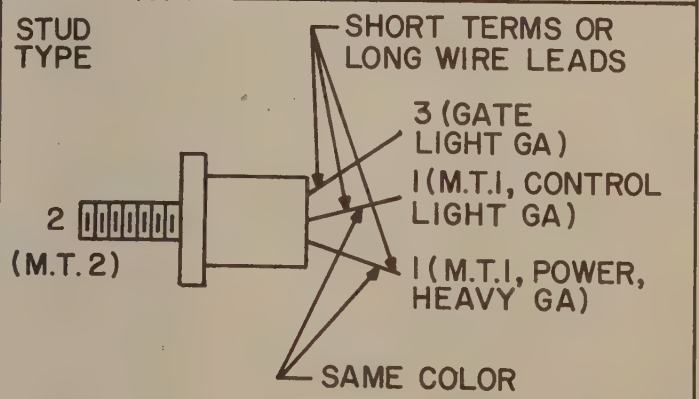


TRIACS

M.T. INDICATES MAIN TERMINAL

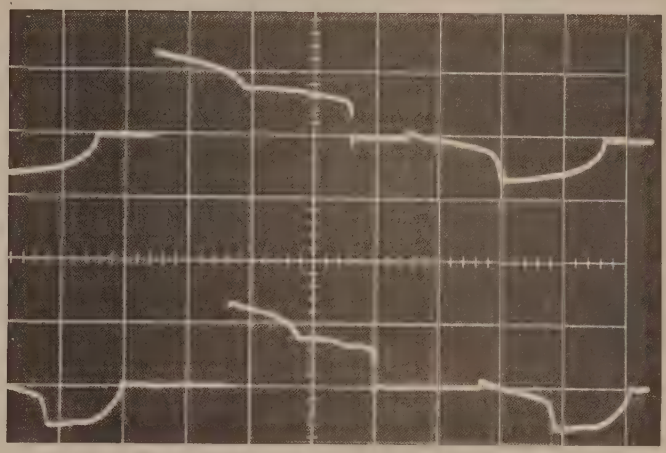


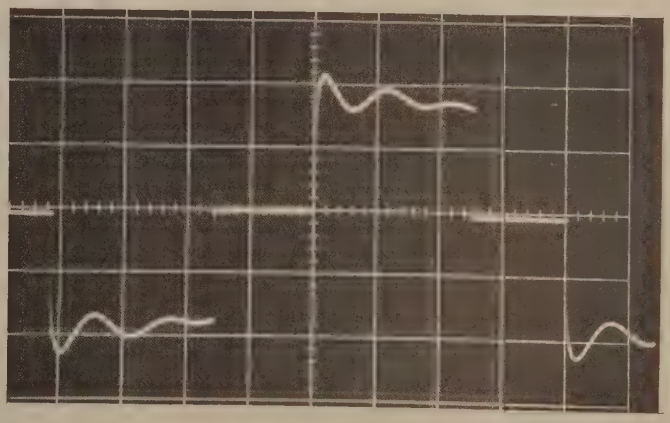




REPAIR PROCEDURE NO.	CHECK/REMEDY
1	Disconnect the capacitor(s) to be tested from the circuit. Use a capacitance bridge or capacitance tester to check any capacitor suspected of failure; however, if such a test instrument is unavailable, an ohmmeter may be used. Connect the negative ohmmeter lead to the positive terminal of the capacitor, and the positive ohmmeter lead to the negative terminal of the capacitor. Initially, the indicated resistance will be low, gradually increasing as the capacitor charges. Initial high resistance indicates an open capacitor, whereas continued low resistance indicates a leaky or shorted capacitor. Replace the capacitor(s) as required.
2	To check a diode, connect an ohmmeter across the diode leads, then reverse the ohmmeter connections. The ohmmeter should indicate high resistance in one direction and low resistance in the opposite direction. Low resistance or high resistance in both directions is an indication that the diode may have failed. If a diode failure is suspected, disconnect one of the leads and recheck the resistances. Replace the diode if it has failed.
3	Remove input power to the Rectifier by operating the AC input circuit breaker to the OFF position. CAUTION: AC power is still present within the Rectifier cabinet at terminal board TB1 and at circuit breaker CB1. Open the Rectifier front cover and connect a DC voltmeter (or multimeter) to terminal board TB5. Terminal number 1 is positive (+), and terminal number 2 is negative (-).

REPAIR PROCEDURE NO.	CHECK/REMEDY
3 (cont'd)	The voltmeter should indicate battery voltage (approximately 24VDC or 48VDC). If battery voltage is not present this indicates that the reference leads are open between the Rectifier and the battery. Correct as required.
4	Remove AC input to the Rectifier by operating the AC input circuit breaker to the OFF position. CAUTION: AC power is still present within the Rectifier cabinet at terminal board TB1 and at circuit breaker CB1. Open the Rectifier front cover and locate CR1 terminal board. Connect an oscilloscope across the G and MT1 terminals of triac CR1. Connect the common oscilloscope lead to the MT1 terminal. After all test connections have been made, insure that all test leads are insulated (or separated) from each other and from surrounding exposed connection points. Start the Rectifier and observe on the oscilloscope the triac firing waveform from circuit card RC-A1. A signal similar to that shown below should appear across the G and MT1 terminals for CR1. If the signal is absent or irregular replace circuit card RC-A1.

REPAIR PROCEDURE NO.	CHECK/REMEDY
4 (cont'd)	 The waveshape, as shown, will be of approximately 5 volts peak-to-peak amplitude with a variable time duration depending on the voltage of the AC input line, the output voltage settings, and the load placed on the Rectifier.
5	Disconnect the triac to be checked. A thyristor tester should be used to check for a main terminal 1 to main terminal 2 open or short. If such a tester is not available, the triac can be checked by the use of an ohmmeter. To check for a main terminal 1 to main terminal 2 short, measure the resistance from terminal to terminal; a low resistance indicates a short. To check for an open or shorted triac gate, measure the resistance of the gate-to-main terminal 1 in both directions. A reading of zero ohms in both directions indicates a shorted triac. A reading of infinity in both directions indicates an open triac. Replace the triac as required.

REPAIR PROCEDURE NO.	CHECK/REMEDY
6	Remove input power to the Rectifier by operating the AC input circuit breaker to the OFF position. CAUTION: AC power is still present within the Rectifier cabinet at terminal board TB1 and at circuit breaker CB1. Open the Rectifier front cover and locate CR1 terminal board. Connect an oscilloscope to the MT1 and MT2 terminals of triac CR1. Connect the oscilloscope common lead to terminal MT1. After all test connections have been made, insure that all test leads are insulated (or separated) from each other and from surrounding exposed connection points. WARNING: When performing this test, the chassis and case of the oscilloscope "floats" at a voltage potential of approximately 400 volts above ground. Servicing personnel must exercise extreme caution that contact between the oscilloscope case and some grounded object is not made while the Rectifier is operating. Start the Rectifier and observe on the oscilloscope the voltage waveform across the triac. This waveform should be similar to the one shown in the photograph below: 

<table>
<tr><th>REPAIR PROCEDURE NO.</th><th>CHECK/REMEDY</th></tr>
<tr><td>6 (Cont'd)</td><td>The waveform, as shown, will be of approximately 400 volts peak amplitude with a variable time duration depending on the voltage of the AC input line, the output voltage settings, and the load placed on the Rectifier. This test is useful in helping to determine if triac CR1 is beginning to fail under operating conditions.</td></tr>
<tr><td>7</td><td>To determine if the load sharing circuitry is operating correctly, connect a DC voltmeter (or multimeter) to the output of the load sharing circuit card, terminals number 2 (-) and number 3 (+) of TB5. Since this circuit provides a linear output voltage with respect to Rectifier output current, the circuit operation may be checked under several load conditions as shown in the table below:
<table>
<tr><th>Percentage Of Rated Rectifier Output Current</th><th>Load Sharing Output Voltage (VDC)</th></tr>
<tr><td>12.5</td><td>1</td></tr>
<tr><td>25</td><td>2</td></tr>
<tr><td>37.5</td><td>3</td></tr>
<tr><td>50</td><td>4</td></tr>
<tr><td>62.5</td><td>5</td></tr>
<tr><td>75</td><td>6</td></tr>
<tr><td>87.5</td><td>7</td></tr>
<tr><td>100</td><td>8</td></tr>
</table>
If paralleled Rectifiers with similar load sharing circuits installed do not proportionately share a load, insure that all output voltage controls are adjusted so that all Rectifier outputs are at the same voltage level. Similarly, all load sharing circuits must be correctly adjusted. Refer to appropriate Rectifier instruction manuals for correct procedures for adjustment of output voltage, and adjustment of load sharing circuitry.</td></tr>
</table>

REPAIR PROCEDURE NO.	CHECK/REMEDY
7 (cont'd)	If, after attempting the required adjustments, the load sharing circuit output voltage is missing or irregular, replace the load sharing circuit card.

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Lorain, Ohio, U.S.A.

LORAIN PRODUCTS (CANADA) LTD.
St. Thomas, Ontario, Canada

December 7, 1973

Form 3085
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Printed in U.S.A.

ELECTRICAL PARTS LIST
LORAIN MODEL L6A50 FLOTROL RECTIFIER
SPEC. NO. 5351-006

This Electrical Parts List is arranged alphabetically by part name. Spare parts are not usually required if adequate standby equipment is available and if the LORAIN EQUIPMENT is installed at an accessible location so that parts can readily be obtained from Lorain Products stock. When ordering parts, please furnish equipment Model No., Spec. No., and Serial No. as given on the equipment nameplate. The quantity of spare parts listed should be sufficient for ten or less assemblies or models for at least 18 months. If a single asterisk (*) appears in the Quantity Recm. Spares column, it indicates the part, assembly, or model is listed more than once, in which case, use the quantity where the item first appears. If two asterisks (**) appear, refer to the sub-list for that assembly or model. If a dash (-) appears, this indicates that spares are not recommended for this part or assembly.

Ref. Desig.	LPC Part No.	Description	Quantity Recm. Spares
ACCESSORIES			
(Quantity of spare parts for an accessory applies only if the accessory is furnished with equipment.)			
A5	4843-817	Equalize Timer Assembly	**
	4826-143	Battery Eliminator Filter Assembly	**
	4846-105	Charge Fail Alarm Card Assembly	1
	4863-077	High/Low Volt Alarm Assembly	**
ASSEMBLIES			
	4331-308	Component Board	**
	4331-610	Component Board	1
	4863-741	High Volt Shutdown Card	1
	4865-760	Regulator/Current Limit Card	1
CAPACITORS			
C1	2714-584	12UF AC	1
C5	2731-383	0.22UF 75 Volt, Electrolytic	-
C23	2717-111	0.1-0.1UF 600 Volt DC	1
C33	2713-237	0.15UF 200 Volt DC	1
C34	2713-142	0.22UF 100 Volt DC	1
C35	2713-142	0.22UF 100 Volt DC	*
C36	2713-152	0.47UF 100 Volt DC	1
C38	2713-178	1UF 100 Volt DC	1
C39	2713-178	1UF 100 Volt DC	*
C40	2713-132	0.1UF 100 Volt DC	1
C41	2713-132	0.1UF 100 Volt DC	*

ELECTRICAL PARTS LIST
LORAIN MODEL L6A50 FLOTROL RECTIFIER
SPEC. NO. 5351-006

Ref. Desig.	LPC Part No.	Description	Quantity Recm. Spares
CIRCUIT BREAKERS			
CB1	2567-218	240 Volt 50/60 Hz	1
CB2	2566-066	9 Amp 65 Volt DC	1
FUSES			
F1	2483-218	0.75 Amp, Cartridge	3
INDICATOR LAMPS			
DS1	2581-208	28 Volt 1.1 Watt, Filament	3
DS2	2581-208	28 Volt 1.1 Watt, Filament	*
DS3	2581-208	28 Volt 1.1 Watt, Filament	*
INDUCTORS			
L1	4425-037	Discharge	-
L2	4415-026	Output	-
L30	4412-038	RFI	-
METERS			
M1	2923-206	0-10 Ammeter, DC	-
M2	2943-211	0-80 Voltmeter, DC	-
RECTIFIERS			
CR2	2821-827		1
CR3	2821-827		*
RELAYS			
K2, K1	2543-797	48 Volt DC	1
RESISTORS			
R4	2651-332	750 Ohm 3 Watt, Fixed	1
R5	2651-332	750 Ohm 3 Watt, Fixed	*
R6	2651-329	500 Ohm 3 Watt, Fixed	1
R8	2683-255	500 Ohm 2 Watt, Variable	1
R9	2683-255	500 Ohm 2 Watt, Variable	*

ELECTRICAL PARTS LIST
LORAIN MODEL L6A50 FLOTROL RECTIFIER
SPEC. NO. 5351-006

Ref. Desig.	LPC Part No.	Description	Quantity Recm. Spares
SWITCHES			
S1	2513-613	DPDT	1
THYRISTORS			
CR1	2865-022	8 Amp 400 Volt	2
TRANSFORMERS			
T1	4522-042	Controlled Ferroresonant	-
MISCELLANEOUS			
	2488-108	Fuseholder	1
	2584-109	Socket, Lamp	1
	2584-792	Cap, Lens, Red	1
	2584-796	Cap, Lens, White	1
	2584-798	Cap, Lens. Green	1

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ELECTRICAL PARTS LIST
LORAIN 4331-308 COMPONENT BOARD ASSEMBLY

This Electrical Parts List is arranged alphabetically by part name. Spare parts are not usually required if adequate standby equipment is available and if the LORAIN EQUIPMENT is installed at an accessible location so that parts can readily be obtained from Lorain Products stock. When ordering parts, please furnish equipment Model No., Spec. No., and Serial No. as given on the equipment nameplate. The quantity of spare parts listed should be sufficient for ten or less assemblies or models for at least 18 months. If a single asterisk (*) appears in the Quantity Recm. Spares column, it indicates the part, assembly, or model is listed more than once, in which case, use the quantity where the item first appears. If two asterisks (**) appear, refer to the sub-list for that assembly or model. If a dash (-) appears, this indicates that spares are not recommended for this part or assembly.

Ref. Desig.	LPC Part No.	Description	Quantity Recm. Spares
CAPACITORS			
C4	2715-257	0.25UF 600 Volt DC	1
RESISTORS			
R1	2652-558	10K Ohm 11 Watt, Fixed	1
R7	2651-540	750 Ohm 65 Watt, Fixed	1
R10	2652-464	220 Ohm 11 Watt, Fixed	1

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ELECTRICAL PARTS LIST
LORAIN 4826-143 48 VOLT BATTERY ELIMINATOR FILTER ASSEMBLY

This Electrical Parts List is arranged alphabetically by part name. Spare parts are not usually required if adequate standby equipment is available and if the LORAIN EQUIPMENT is installed at an accessible location so that parts can readily be obtained from Lorain Products stock. When ordering parts, please furnish equipment Model No., Spec. No., and Serial No. as given on the equipment nameplate. The quantity of spare parts listed should be sufficient for ten or less assemblies or models for at least 18 months. If a single asterisk (*) appears in the Quantity Recm. Spares column, it indicates the part, assembly, or model is listed more than once, in which case, use the quantity where the item first appears. If two asterisks (**) appear, refer to the sub-list for that assembly or model. If a dash (-) appears, this indicates that spares are not recommended for this part or assembly.

Ref. Desig.	LPC Part No.	Description	Quantity Recm. Spares
CAPACITORS			
C11	2731-324	750 Ohm 20 Watt, Fixed	1
RESISTORS			
R3	2652-621	8500UF 75 Volt, Electrolytic	-

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ELECTRICAL PARTS LIST
LORAIN 4843-817 EQUALIZE TIMER ASSEMBLY

This Electrical Parts List is arranged alphabetically by part name. Spare parts are not usually required if adequate standby equipment is available and if the LORAIN EQUIPMENT is installed at an accessible location so that parts can readily be obtained from Lorain Products stock. When ordering parts, please furnish equipment Model No., Spec. No., and Serial No. as given on the equipment nameplate. The quantity of spare parts listed should be sufficient for ten or less assemblies or models for at least 18 months. If a single asterisk (*) appears in the Quantity Recm. Spares column, it indicates the part, assembly, or model is listed more than once, in which case, use the quantity where the item first appears. If two asterisks (**) appear, refer to the sub-list for that assembly or model. If a dash (-) appears, this indicates that spares are not recommended for this part or assembly.

Ref. Desig.	LPC Part No.	Description	Quantity Recm. Spares
FUSES			
F1	2483-211	0.25 Amp, Cartridge	3
RELAYS			
K1	2546-482	115 Volt AC	1
TIMERS			
M1	2544-452	Reset	1
MISCELLANEOUS			
XF1	2488-108	Fuseholder	1
XK1	4233-308	Relay Socket Card	-

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ELECTRICAL PARTS LIST
LORAIN 4863-077 HIGH/LOW VOLTAGE ALARM ASSEMBLY

This Electrical Parts List is arranged alphabetically by part name. Spare parts are not usually required if adequate standby equipment is available and if the LORAIN EQUIPMENT is installed at an accessible location so that parts can readily be obtained from Lorain Products stock. When ordering parts, please furnish equipment Model No., Spec. No., and Serial No. as given on the equipment nameplate. The quantity of spare parts listed should be sufficient for ten or less assemblies or models for at least 18 months. If a single asterisk (*) appears in the Quantity Recm. Spares column, it indicates the part, assembly, or model is listed more than once, in which case, use the quantity where the item first appears. If two asterisks (**) appear, refer to the sub-list for that assembly or model. If a dash (-) appears, this indicates that spares are not recommended for this part or assembly.

Ref. Desig.	LPC Part No.	Description	Quantity Recm. Spares
ASSEMBLIES			
HLVA	4337-609	Component Board	1
RELAYS			
K1	2543-797	48 Volt DC, 4PDT	1

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CIRCUIT NOTES

101

DESIG	FUSE AMP	POTENTIAL	ONE PER

BATTERY AND PWR SUPPLIES SYMBOLS	VOLTAGE RANGE
-BAT, +BAT	48 TO 54V D-C
-6.8, +6.8	6.12 TO 7.48V D-C
+50	47 TO 53V D-C

102 UNLESS OTHERWISE SPECIFIED, THE FOLLOWING OPTIONS ARE FURNISHED R,M

FEATURE OR OPTION		PROVIDE APP FIG	PROVIDE APP OR WRG	PROVIDE QTY	LOC
CHG FAIL ALARM		2	S	1	1D0
HIGH-LOW VOLTAGE ALARM		1	N	1	1C4
EXT REF	REQ'D	3	T	1	2C9
	NOT REQ'D	3	R	1	2B9
BATTERY ELIMINATOR	REQ'D	3	K,M	1	2H3, 2B4, 2B5, 2H2
	NOT REQ'D				
BATTERY CHARGER	REQ'D				
	NOT REQ'D	3	K,M	1	2H3, 2B4, 2B5, 2H2
EQUALIZE TIMER	REQ'D	4	X	1	2B7, 2D1, 2F0, 2G0, 1E4
	NOT REQ'D	3	W	1	2F0, 2B7

EQUIPMENT NOTES

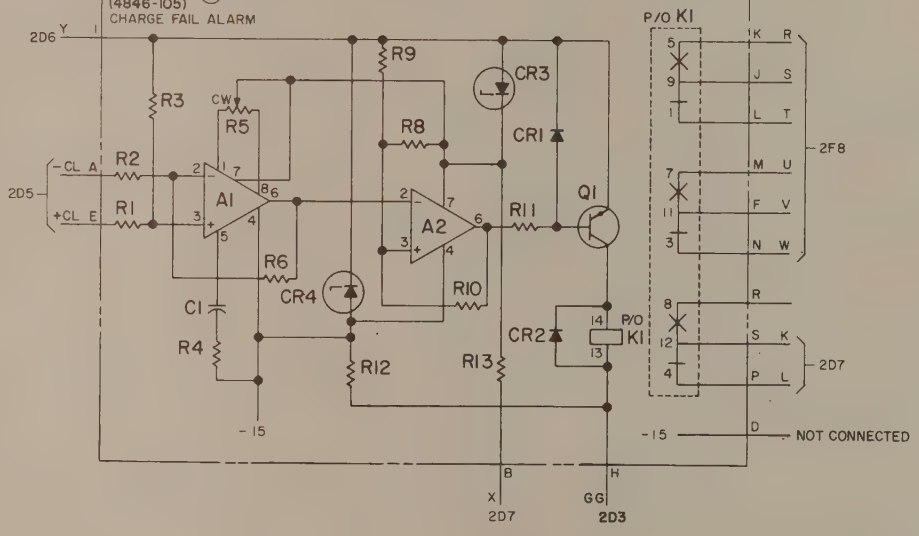
201 REFER TO PD-5351-006 FOR EXTERNAL CONNECTIONS, FUSING AND WIRE SIZES

202. EQUALIZE TIMER ASSEMBLY IS EXTERNALLY MOUNTED.

FIG. 2

CFA-A4

CP-CFA (S)
(4846-105)
CHARGE FAIL ALARM

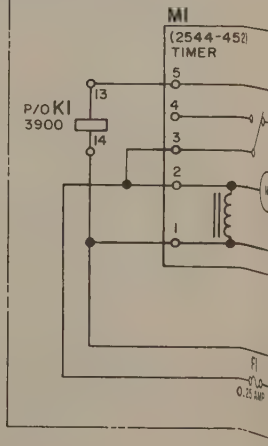


HLVA-A3

CP-HLVA (4337-60)
HIGH-LOW VOLTAGE

ETA-A5 NOTE 202

CP-ETA (X)
(4843-817)
EQUALIZE TIMER ASSY.



INFORMATION NOTES

301 UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS AND VALUES PRECEDED BY THE SYMBOL +(PLUS) OR -(MINUS) ARE IN VOLTS

302 CODES WITHIN PARENTHESES, AS (4846-105), REPRESENT L P C PART NUMBERS

303 SEE WIRING DIAGRAM T-5351-006 FOR LPC PART NUMBER OF COMPONENTS

304 HIGHEST REF DESIG USED ON THIS DRAWING

RES	CAP	INDUCTOR
R10	C41	L30
NOT USED		
R2	C2,3,6-10, 12-19	L3-L19
	C20,C22 C24-29 C30-32 C37	L20-29

REVISIONS			
2	1831-849	6 21	CR4 AND CR6 ADDED, F6 REMOVED, WDG NO. 3 ADDED, TERMINAL NUMBERS OF T1 CHANGED TO COLOR CODE
3	1832817	11	CHANGE IN RFI SUPPRESION
4	1833236	7 24 73	"X" OPTION EQUALIZE TIMER ADDED
5	1833438	9 14 73	HLVA AND HVS NEG SENSE AND CFA NEG BAT CONNECTION POINTS CHANGED
6	1832549	10 26 73	RFI CAP. C40 AND C41 ADDED. TERMINATION OF DS3 CHGD. VALUE OF R7 CHGD. I-A5 CARD ADDED. RC-A1 CARD CHANGED.
7	1834248		WIRE COLOR CORRECTED AT T1 VIOLET WAS GREEN
8	1834206	6 21 74	LOCAL NEG. SENSE MOVED FROM LOAD TO LINE SIDE OF CB2; TB10 ADDED; C23, C24 REPLACED BY DUAL CAP. CAN. C23

FIG. 1

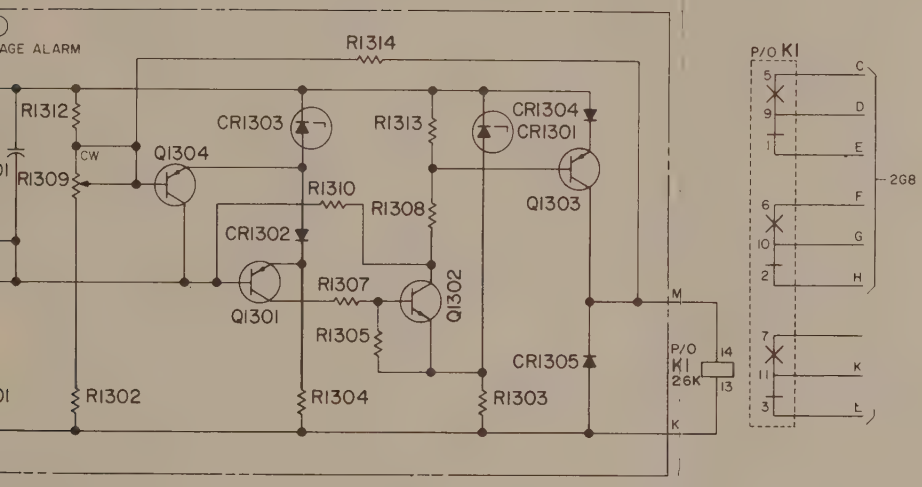
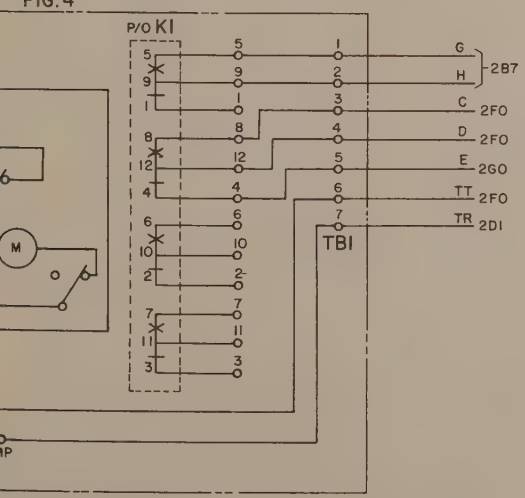


FIG. 4



SCHEMATIC DIAGRAM FOR MODEL L6A50 SPEC 5351-006	DESIGN J. Kalivas	ISS 8	
	REPRO BY J. Waugh	DATE 4-11-72	
	CHECKED BY A. Mucha	DATE 4-11-72	
	APPROVED BY J. Kalivas	DATE 4-11-72	
	APPROVED BY J. Mitchell	DATE 5-2-72	
	RATING STANDARD		
	SD-5351-006		
LORAIN PRODUCTS CORPORATION LORAIN, OHIO LORAIN PRODUCTS (CANADA) LTD., ST. THOMAS ONTARIO	DWG SIZE D	SHEET OF 2	

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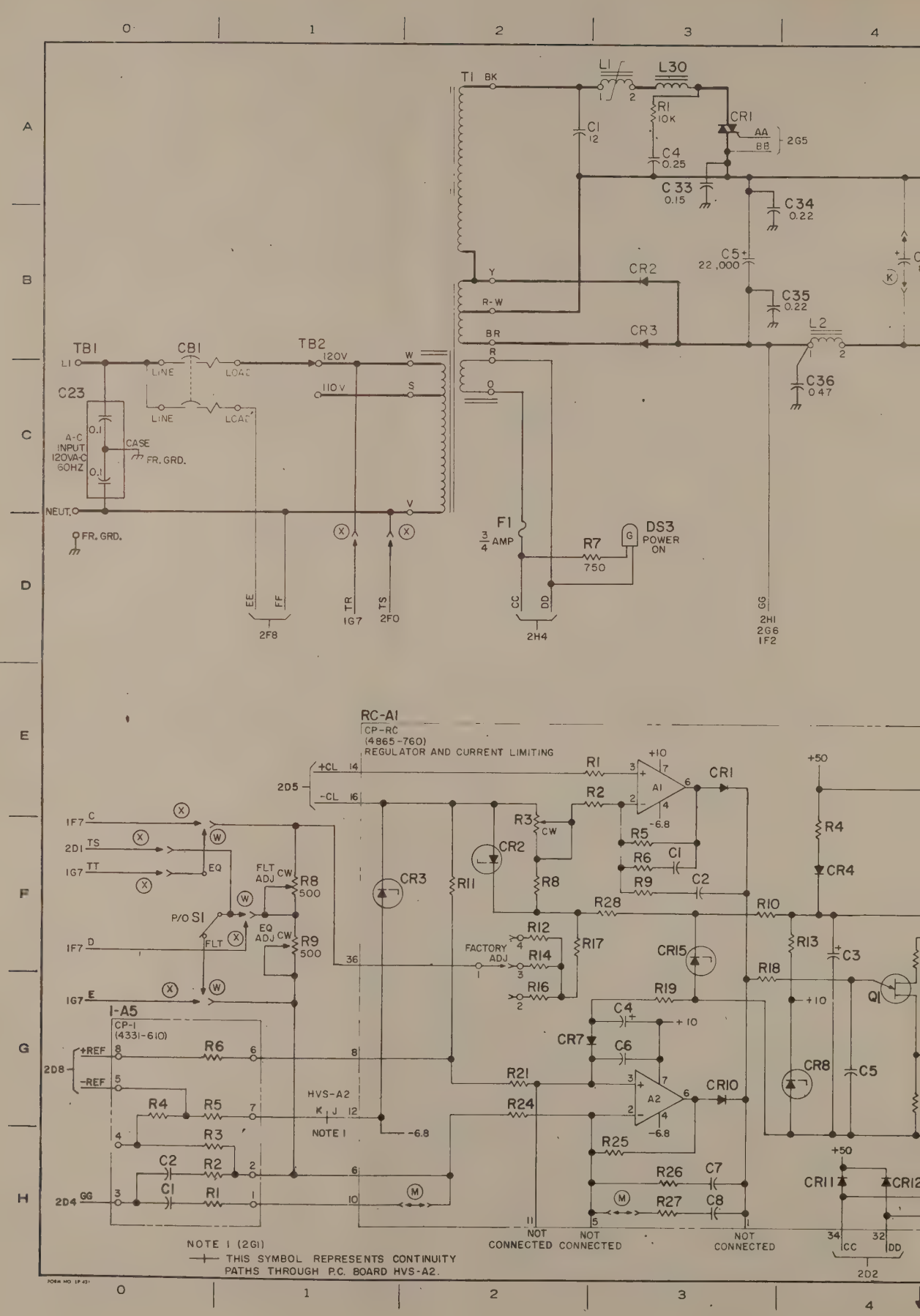
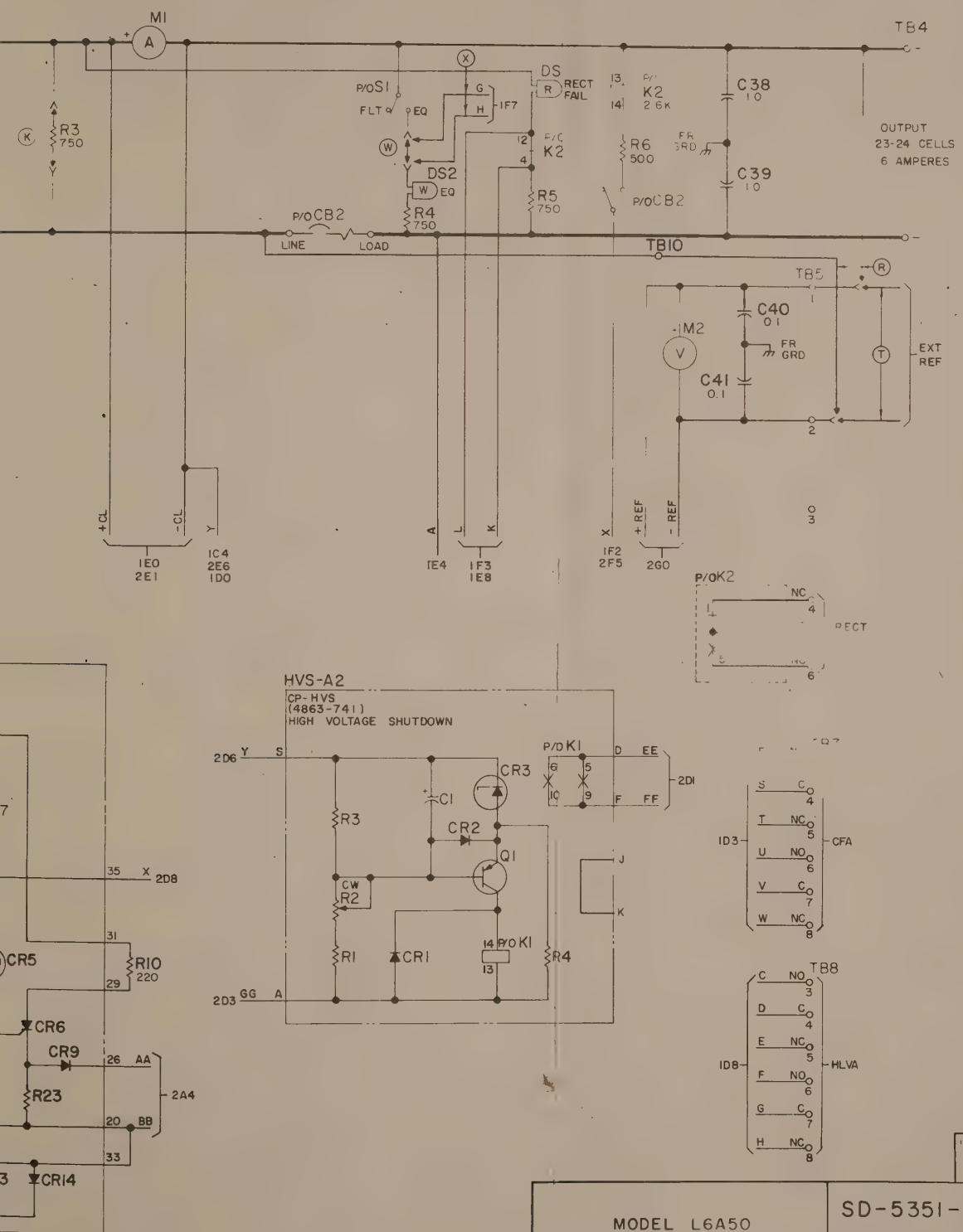

T1 BK
L1
L30
R1 10K
CR1
AA
BB
2G5
C1 12
C4 0.25
C 33 0.15
C34 0.22
C5 22,000
CR2
Y
R-W
BR
R
O
C35 0.22
CR3
L2
C36 0.47
TB1
L1
CB1
LINE
LOAD
TB2
120V
110V
W
S
V
C23
A-C INPUT 120VA-C 60HZ
0.1
CASE
FR. GRD.
NEUT.
EE
FF
2F8
TR
1G7
TS
2F0
F1
3/4 AMP
R7 750
DS3 POWER ON
CC
DD
2H4
GG
2H1
2G6
1F2
RC-A1
CP-RC
(4865-760)
REGULATOR AND CURRENT LIMITING
+CL 14
-CL 16
2D5
R1
R2
R3 CW
R5
R6
C1
R9
C2
R8
R11
R28
R10
R12
R14
R16
R17
FACTORY ADJ
CR15
R18
R19
C4
C6
CR7
R21
R24
R25
R26
C7
R27
C8
CR10
CR8
C5
R13
C3
Q1
R4
CR4
CR11
CR12
A1
A2
+10
-6.8
+50
FLT ADJ CW
R8 500
EQ ADJ CW
R9 500
EQ
FLT
P/O S1
1F7 C
1F7 D
2D1 TS
1G7 TT
1G7 E
CR3
I-A5
CP-I
(4331-610)
+REF
-REF
2D8
R6
R4
R5
R3
C2
R2
C1
R1
2D4 GG
HVS-A2
NOTE 1
NOTE 1 (2G1)
THIS SYMBOL REPRESENTS CONTINUITY PATHS THROUGH P.C. BOARD HVS-A2.
NOT CONNECTED
NOT CONNECTED
NOT CONNECTED
2D2
CC
DD

FIG. 3
POWER CIRCUIT

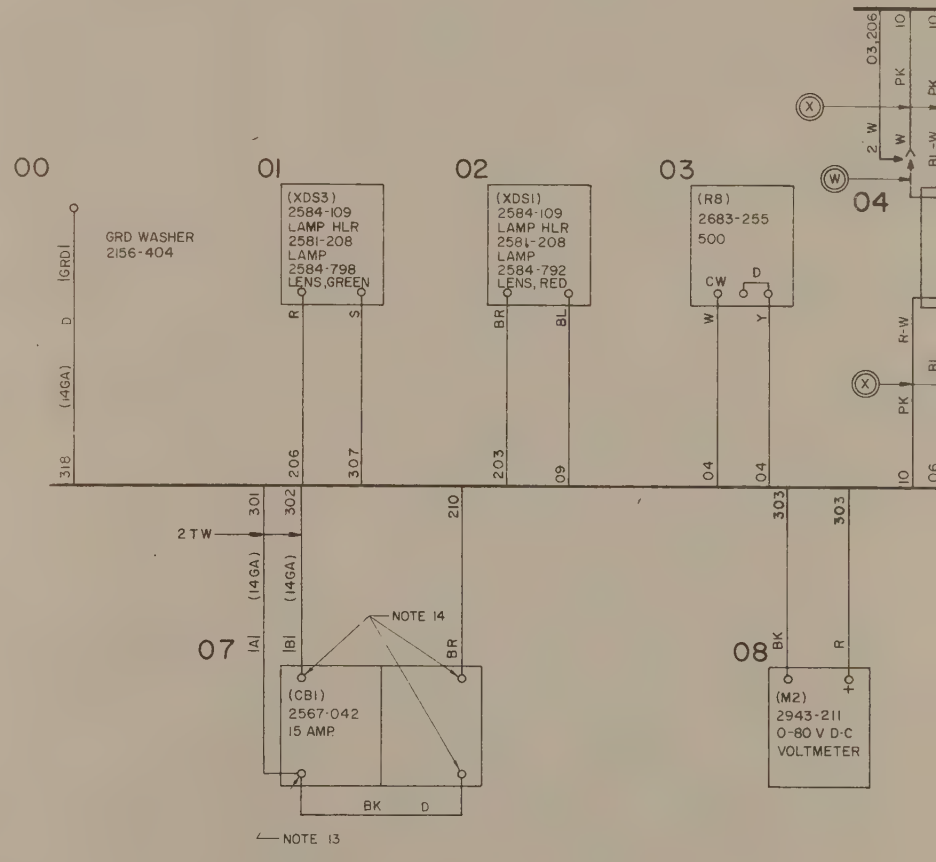


MODEL L6A50	SD-5351-006
LORAIN PRODUCTS CORPORATION	DWG SIZE D

ISSUE 6

SD AND T DRAWING ISSUES AS FOLLOWS
SD - 5351-006
1 2 3 4 5 6 7 8
T - 5351-006
1 2 3 4 5 6 7 8

FIG. 1
METER PANEL



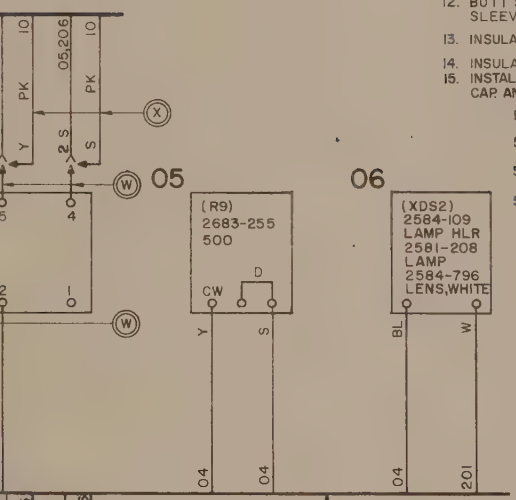
6	1832549	REDESIGN J. HORNCAK
7	1834248	WIRE COLOR CHANGED
8	1834206	WIRING CHANGES AT LOC 6-19-74 200,209-1,303,304,C23 AND 24 LOC 301 WERE 2715-251 C23 LOC 306-1, TBIO LOC. 209-1 AND NOTE 15 ADDED C24 REMOVED.

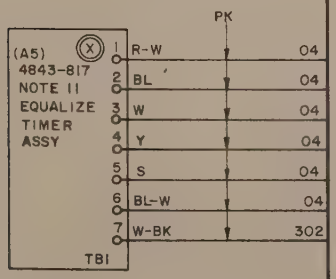
MANUFACTURING NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL WIRES TO BE 20 GA STRANDED.
2. D-INDICATES LEAD IS A JUMPER
3. BI-INDICATES TERMINAL NEAREST MTG SURFACE
4. (H1), (H2) ETC. - WIRES RUN THRU CORRESPONDINGLY DESIGNATED HOLES.
5. PT-LEADS WHICH ARE PART OF COMPONENTS OR SUB ASSEMBLIES.
6. 2TW-INDICATES TWISTED PAIR
7. BB-DENOTES BUS BAR.
8. UNLESS OTHERWISE SPECIFIED: RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS.
9. INSULATE PIGTAIL RESISTOR AND CAPACITOR LEADS WITH SLEEVING L.P.C. PT. NO. 1675-356, WHERE NECESSARY
10. PK-LEAD SUPPLIED AS PART OF OPTIONAL APPARATUS
11. (X) OPTION, EQUALIZE TIMER ASSEMBLY IS MOUNTED EXTERNALLY, SEE FORM 3082 FOR INSTALLATION.
12. BUTT SPLICE LEADS TOGETHER AND INSULATE WITH SLEEVING LPC PT. NO. 1675-364
13. INSULATE CONNECTIONS WITH SLEEVING L.P.C. PT. NO. 1675-376
14. INSULATE CONNECTIONS WITH SLEEVING L.P.C. PT. NO. 1675-372
15. INSTALL NO. 6 INT. TOOTH LOCKWASHER L.P.C. PT. NO. 2155-310 BETWEEN CAP. AND MTG. PANEL TO INSURE CAP. IS GROUNDED.

ENGRG NOTES:

51. (K) INDICATES OPTION FOR BAT. ELIM. LPC PT. NO. 4826-143
52. (R) INDICATES LOCAL REF.
53. (N) INDICATES OPTION FOR HLVA LPC PT NO. 4863-077.





WIRING DIAGRAM
FOR
MODEL L6A50

DESIGN	JJJ
ISS.	
DRAWN BY	J. HORNIS
DATE	3/6/72
CHECKED BY	
DATE	
APPROVED BY	
DATE	
APPROVED BY	
DATE	
RATING	

T-5351-006

LORAIN PRODUCTS CORPORATION
LORAIN, OHIO
LORAIN PRODUCTS (CANADA) LTD., ST THOMAS, ONTARIO

DWG SIZE D

SHEET 1 OF 3

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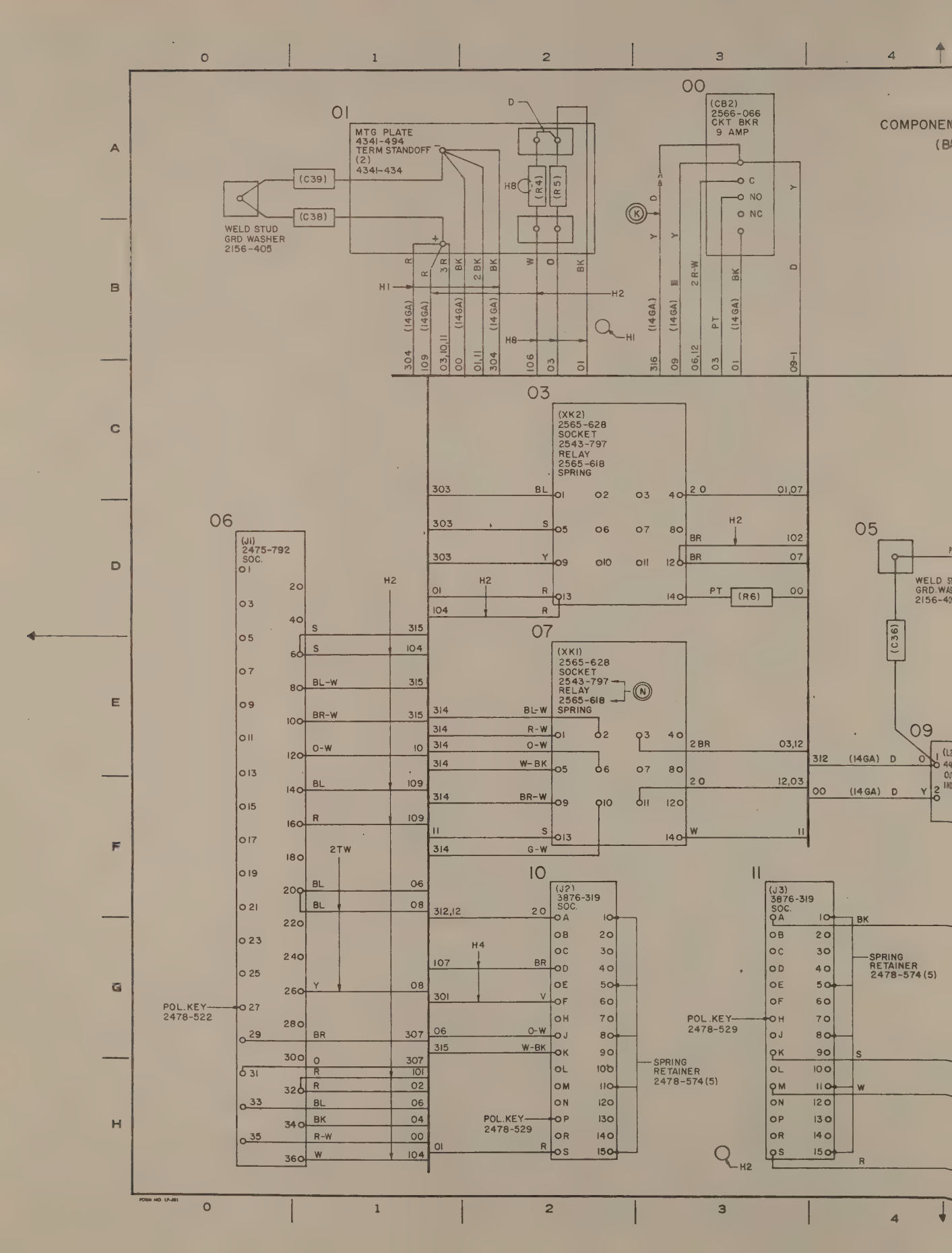
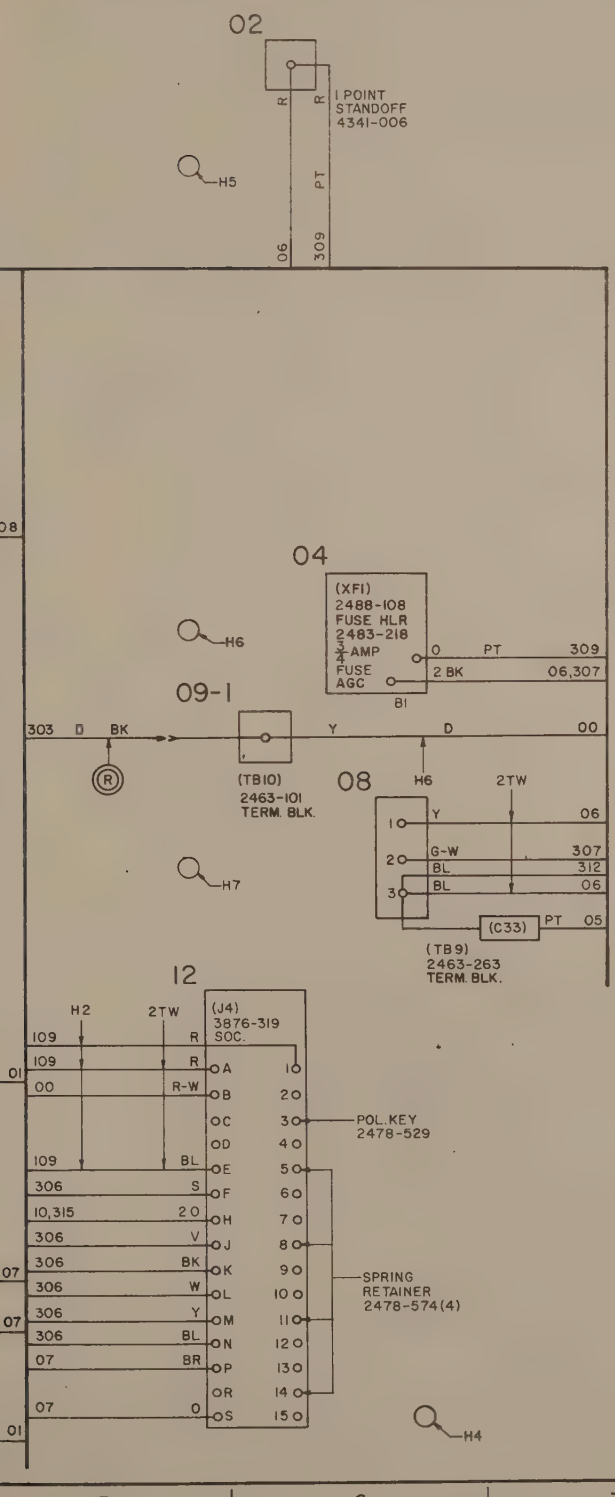

01
MTG PLATE
4341-494
TERM STANDOFF
(2)
4341-434
(C39)
(C38)
WELD STUD
GRD WASHER
2156-405
H8
(R4)
(R5)
H1
H2
00
(CB2)
2566-066
CKT BKR
9 AMP
C
NO
NC
03
(XK2)
2565-628
SOCKET
2543-797
RELAY
2565-618
SPRING
(R6)
06
(J1)
2475-792
SOC.
2TW
POL.KEY
2478-522
07
(XK1)
2565-628
SOCKET
2543-797
RELAY
2565-618
SPRING
05
WELD ST
GRD.WAS
2156-40
(C36)
09
10
(J2)
3876-319
SOC.
H4
POL.KEY
2478-529
SPRING
RETAINER
2478-574(5)
11
(J3)
3876-319
SOC.
POL.KEY
2478-529
SPRING
RETAINER
2478-574(5)
COMPONEN
(B

G. PANEL
DE)



PIGTAIL COMPONENT INFORMATION			
REF DESIG.	LPC. PART. NO.	VALUE	LOC
C33	2713-237	0.15	08
C36	2713-152	0.47	05
C38	2713-178	1.0	01
C39	2713-178	1.0	01
R4	2651-332	750	01
R5	2651-332	750	01
R6	2651-329	500	03

DRAWING ISSUE
6
7
8

ISSUE 8

MODEL L6A50

T-5351-006

LORAIN PRODUCTS CORPORATION

DWG SIZE D

SHT 2

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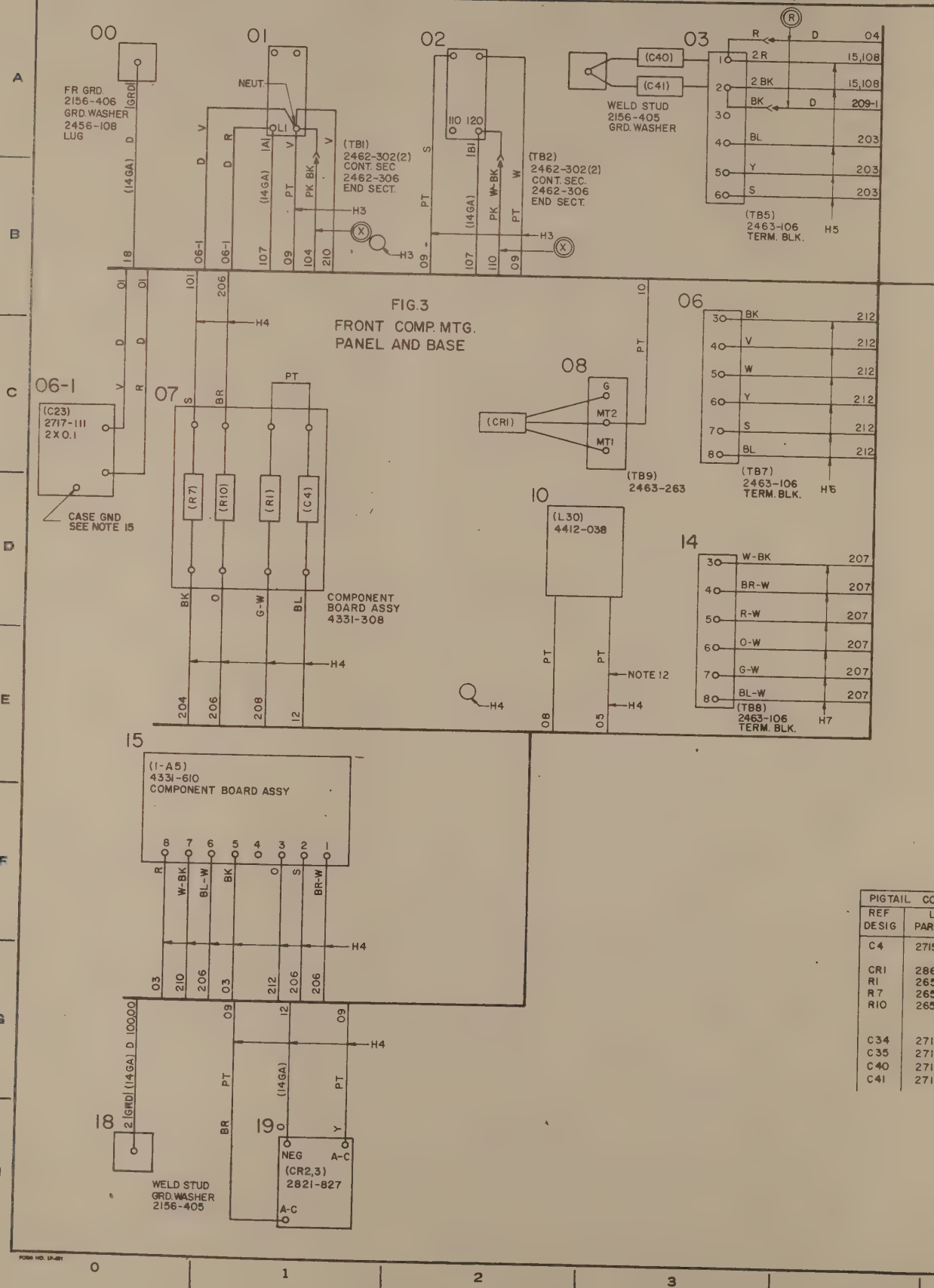
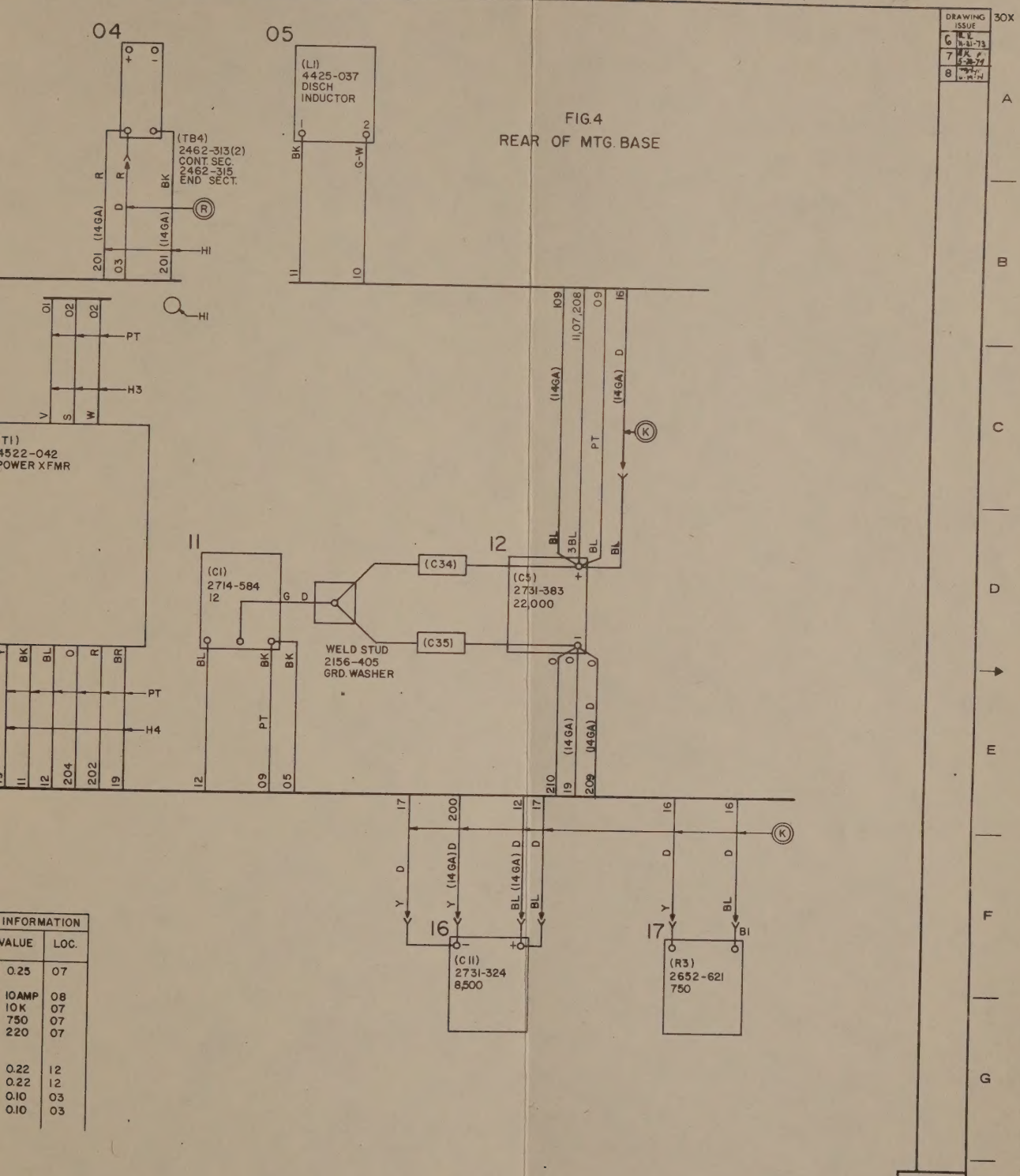


PIGTAIL	CO
REF DESIG	PAR
C4	271
CR1	286
R1	265
R7	265
R10	265
C34	271
C35	271
C40	271
C41	271



INFORMATION	
VALUE	LOC.
0.25	07
10AMP	08
10K	07
750	07
220	07
0.22	12
0.22	12
0.10	03
0.10	03

DRAWING ISSUE	
6	11-21-73
7	2-28-74
8	4-15-74

ISSUE 8

MODEL L6A50	T-5351-006
LORAIN PRODUCTS CORPORATION	DWG SIZE D
	SHEET 3
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